Space Elevator Stage 1:
Through the Stratosphere

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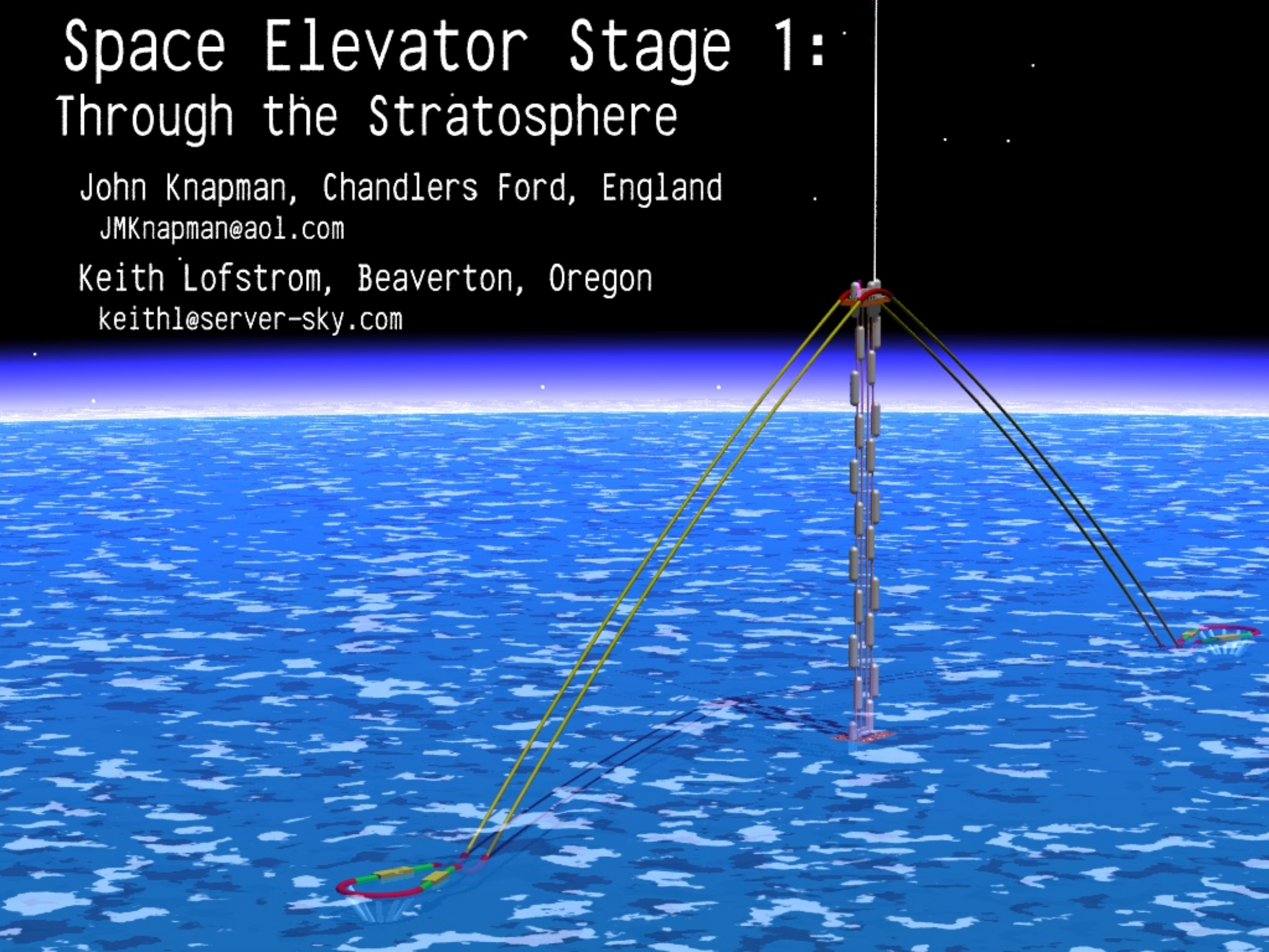
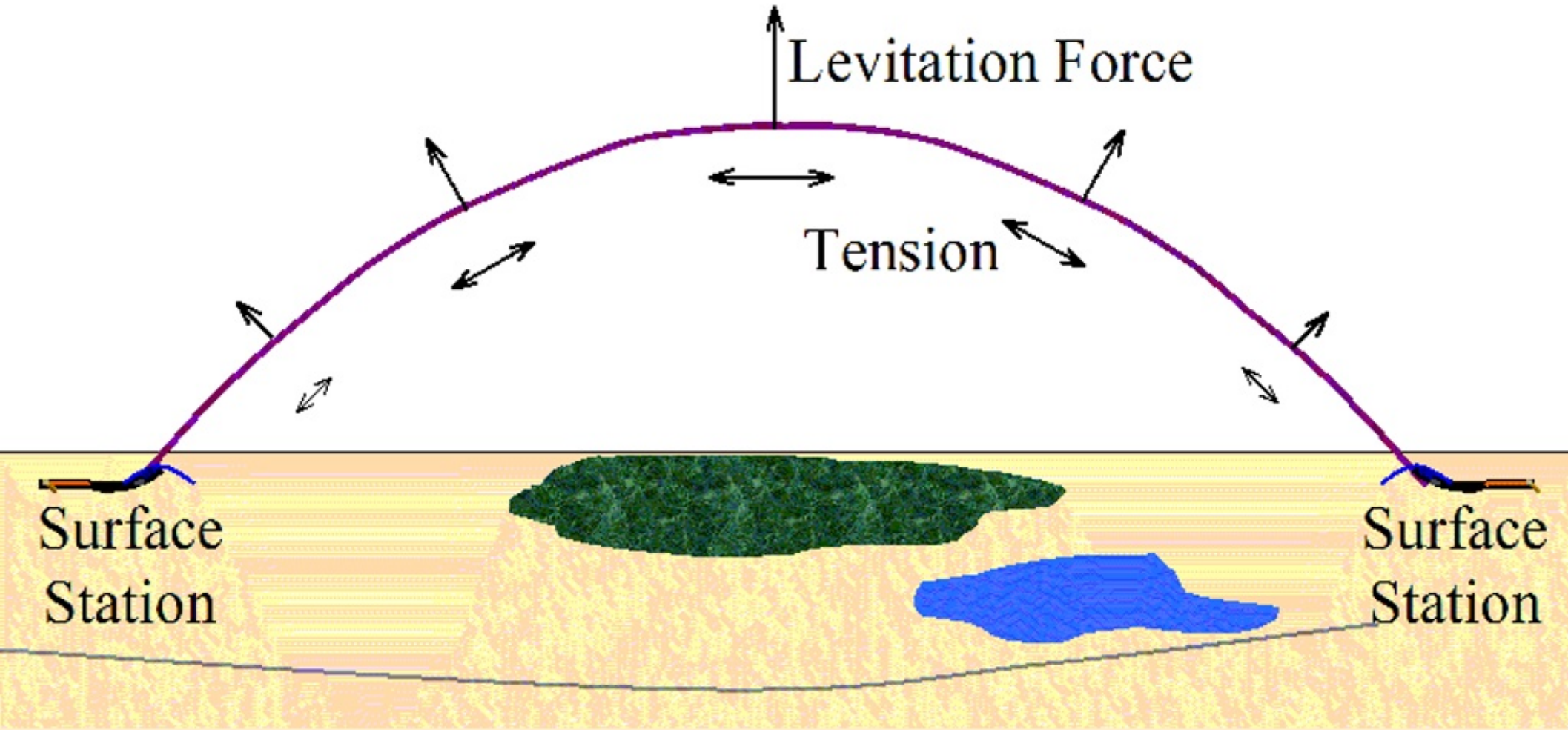
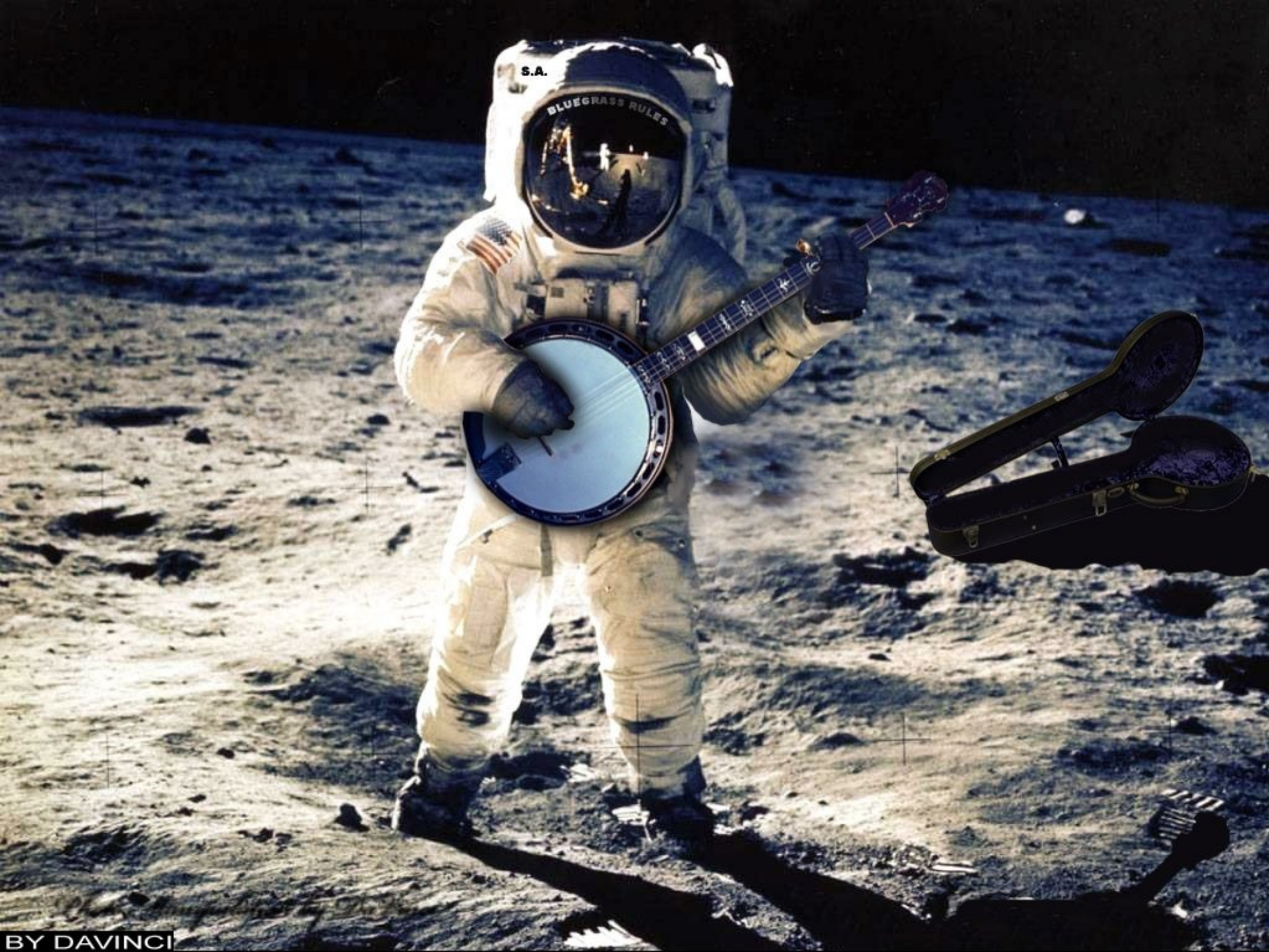
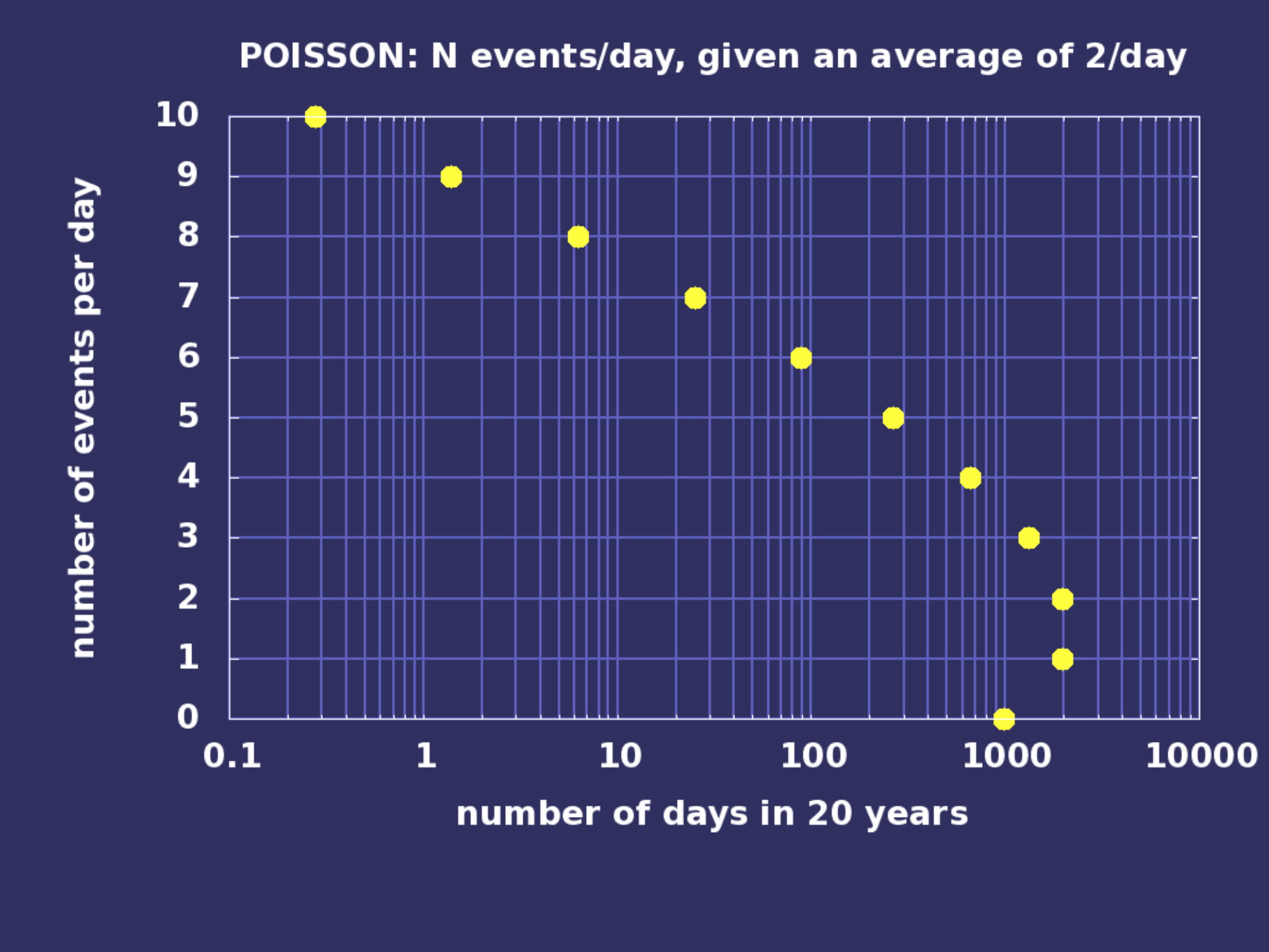


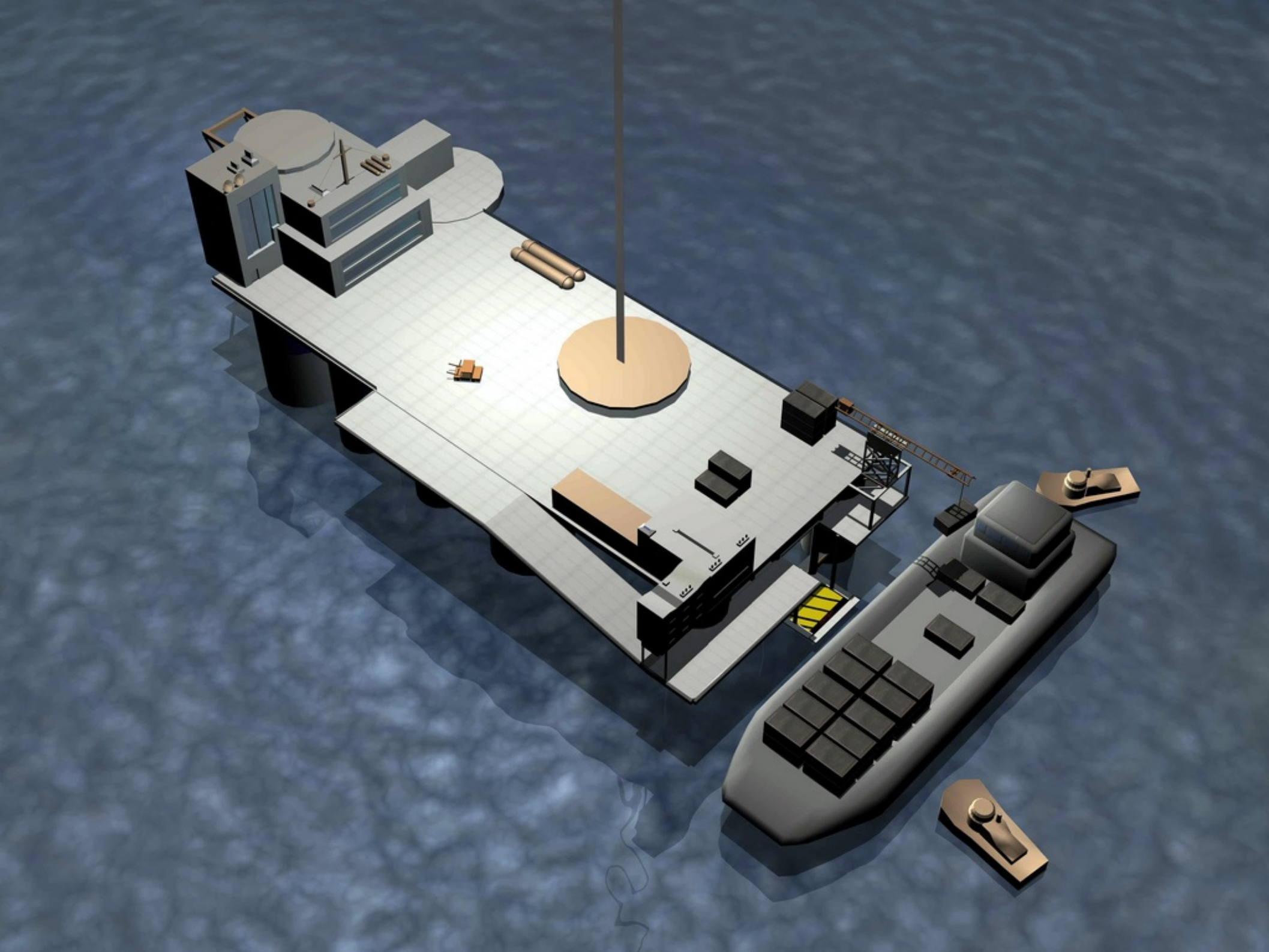
http://www.spacecable.org.uk

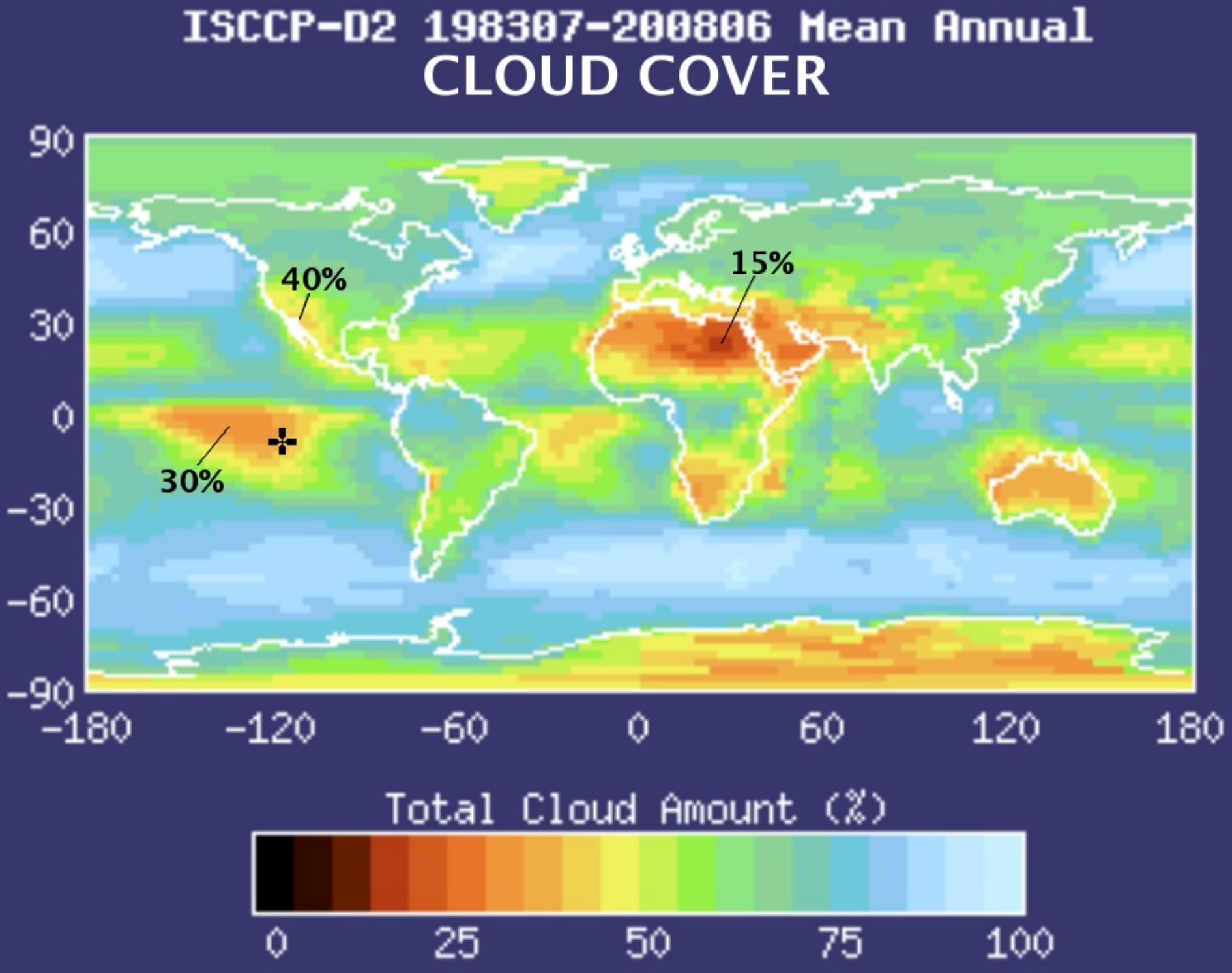


http://launchloop.com

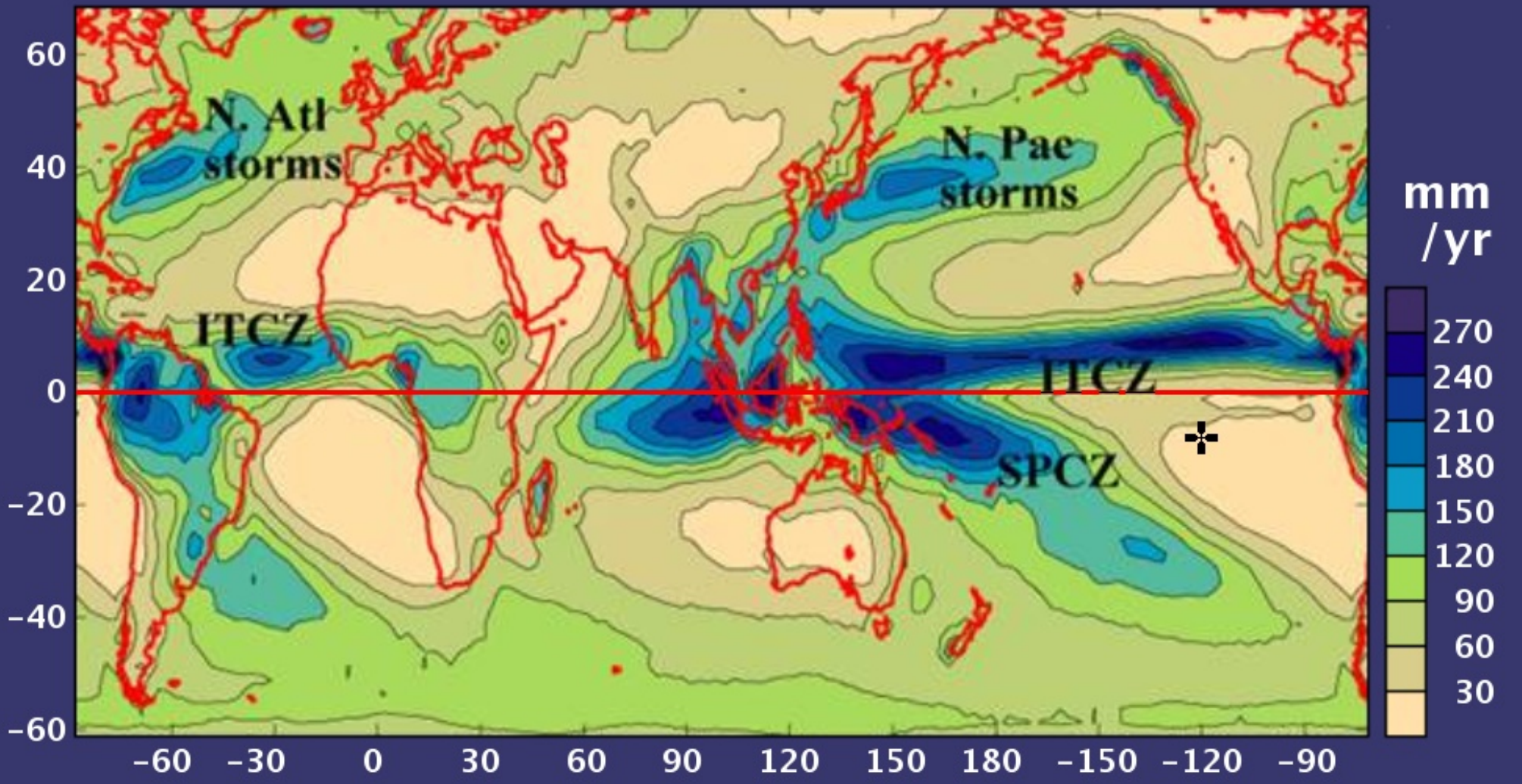

S.A.
BLUEGRASS RULES
BY DAVINCI

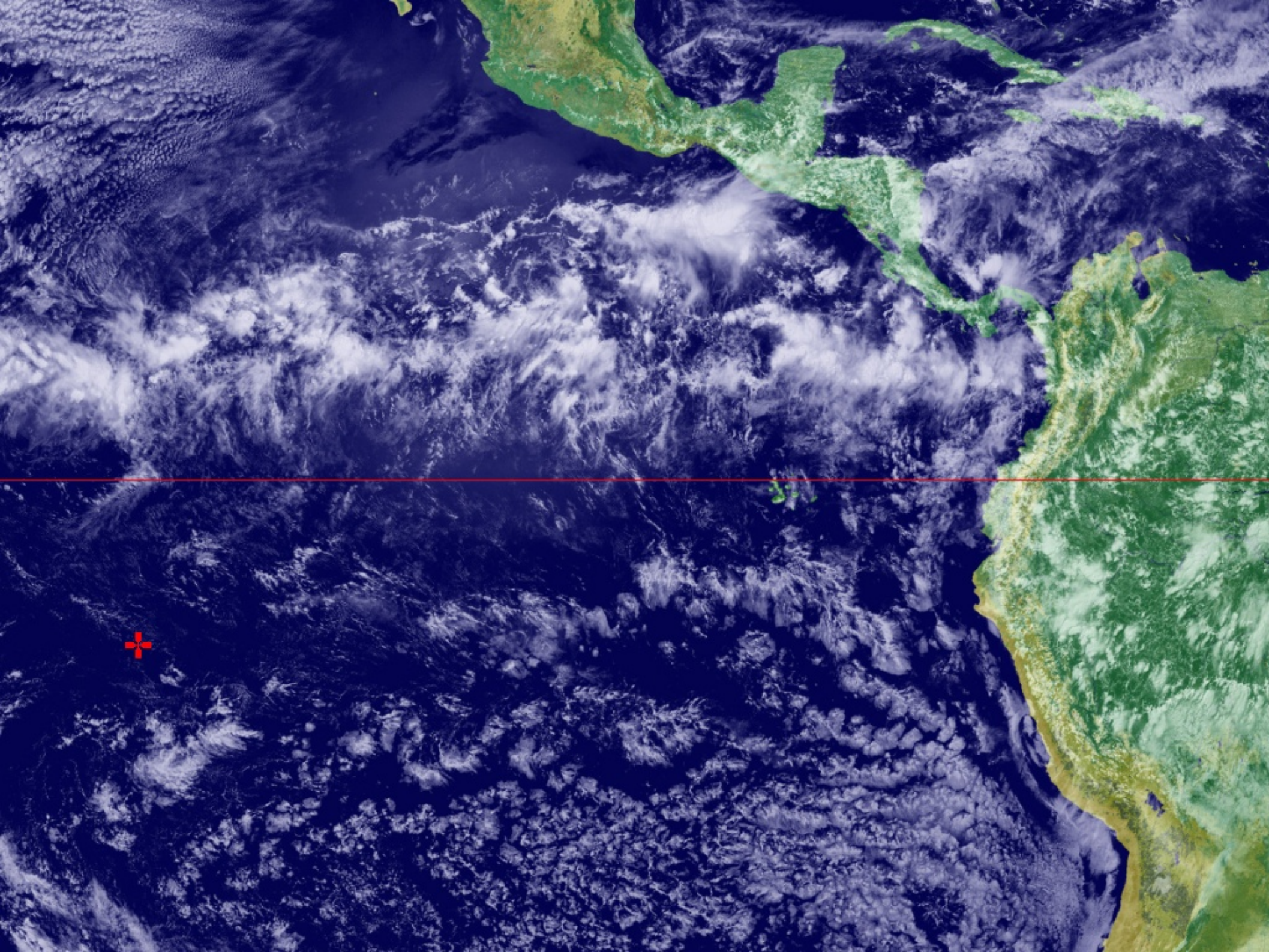

POISSON: N events/day, given an average of 2/day
number of events per day
0
1
2
3
4
5
6
7
8
9
10
0.1
1
10
100
1000
10000
number of days in 20 years

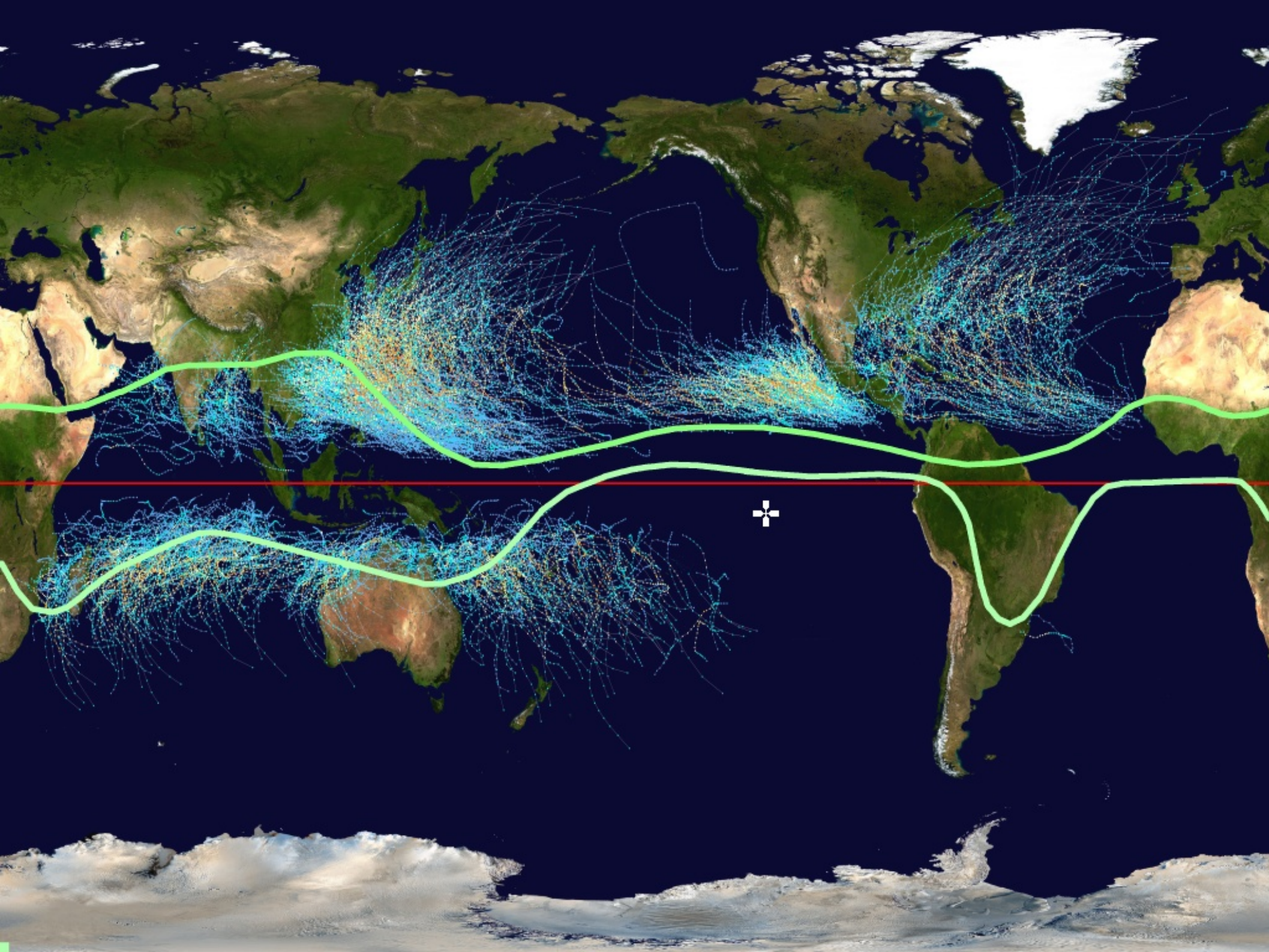



ISCCP-D2 198307-200806 Mean Annual
CLOUD COVER
90
60
30
0
-30
-60
-90
-180
-120
-60
0
60
120
180
40%
15%
30%
Total Cloud Amount (%)
0
25
50
75
100

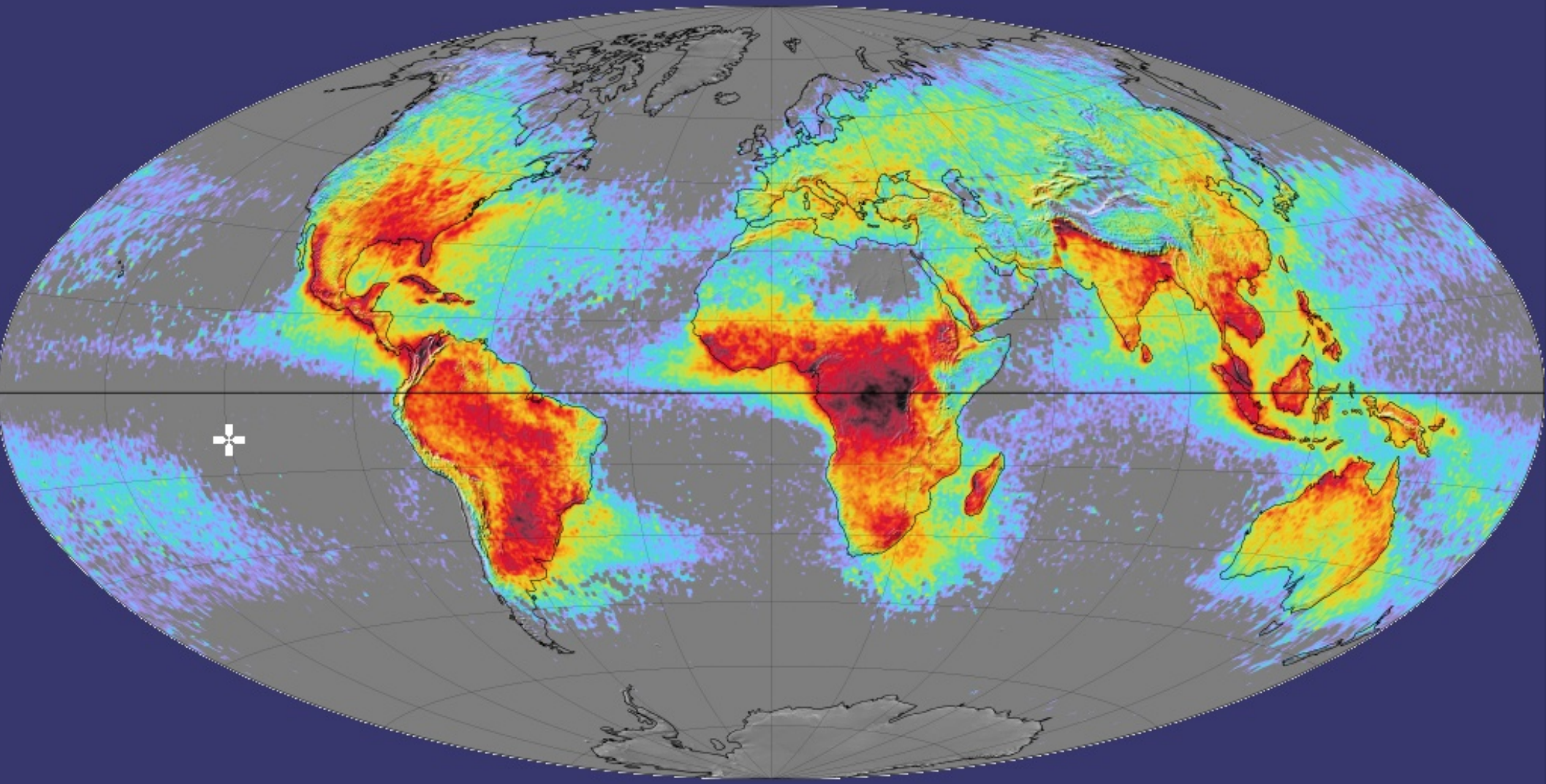
Average Annual Rainfall

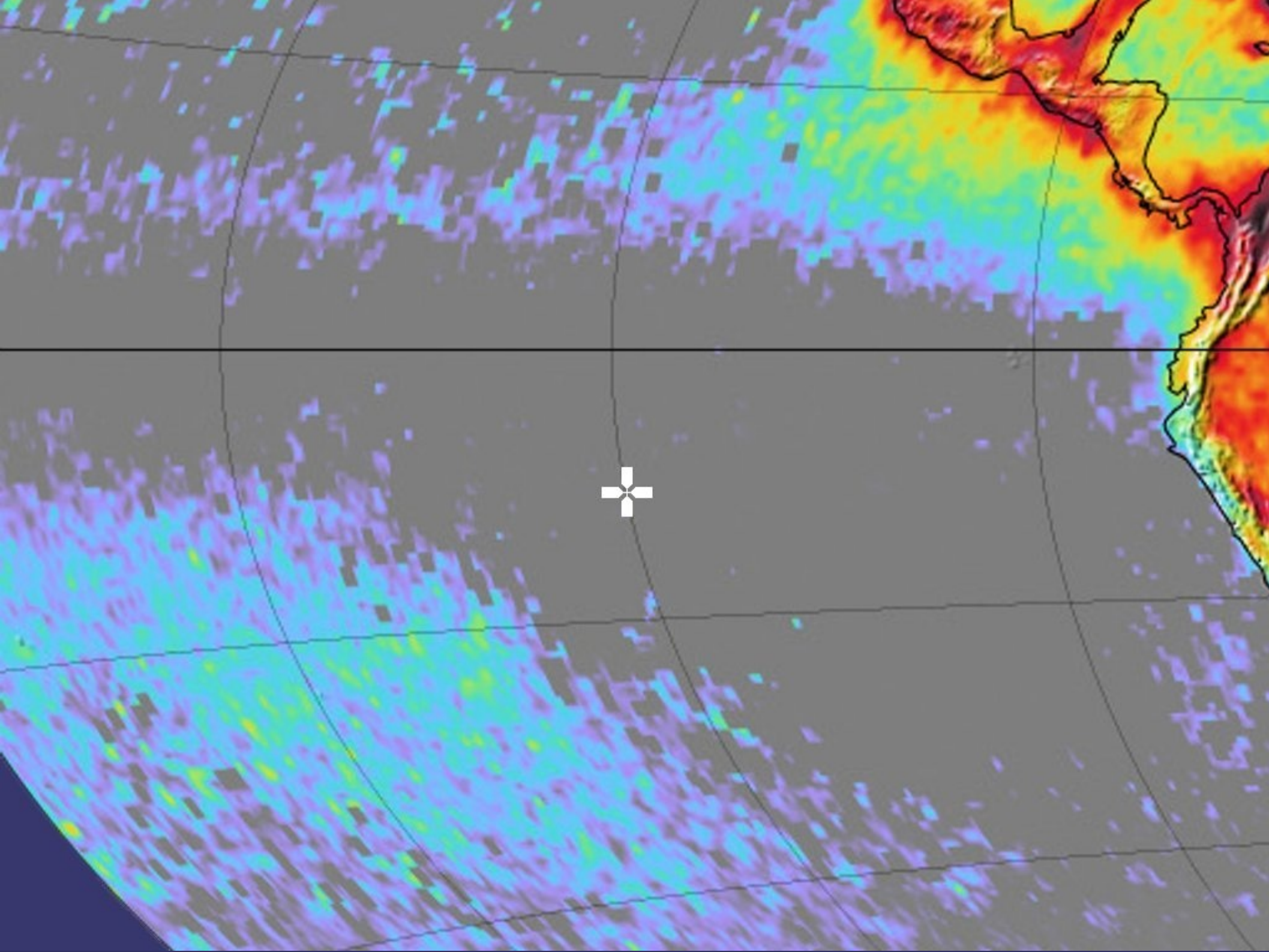


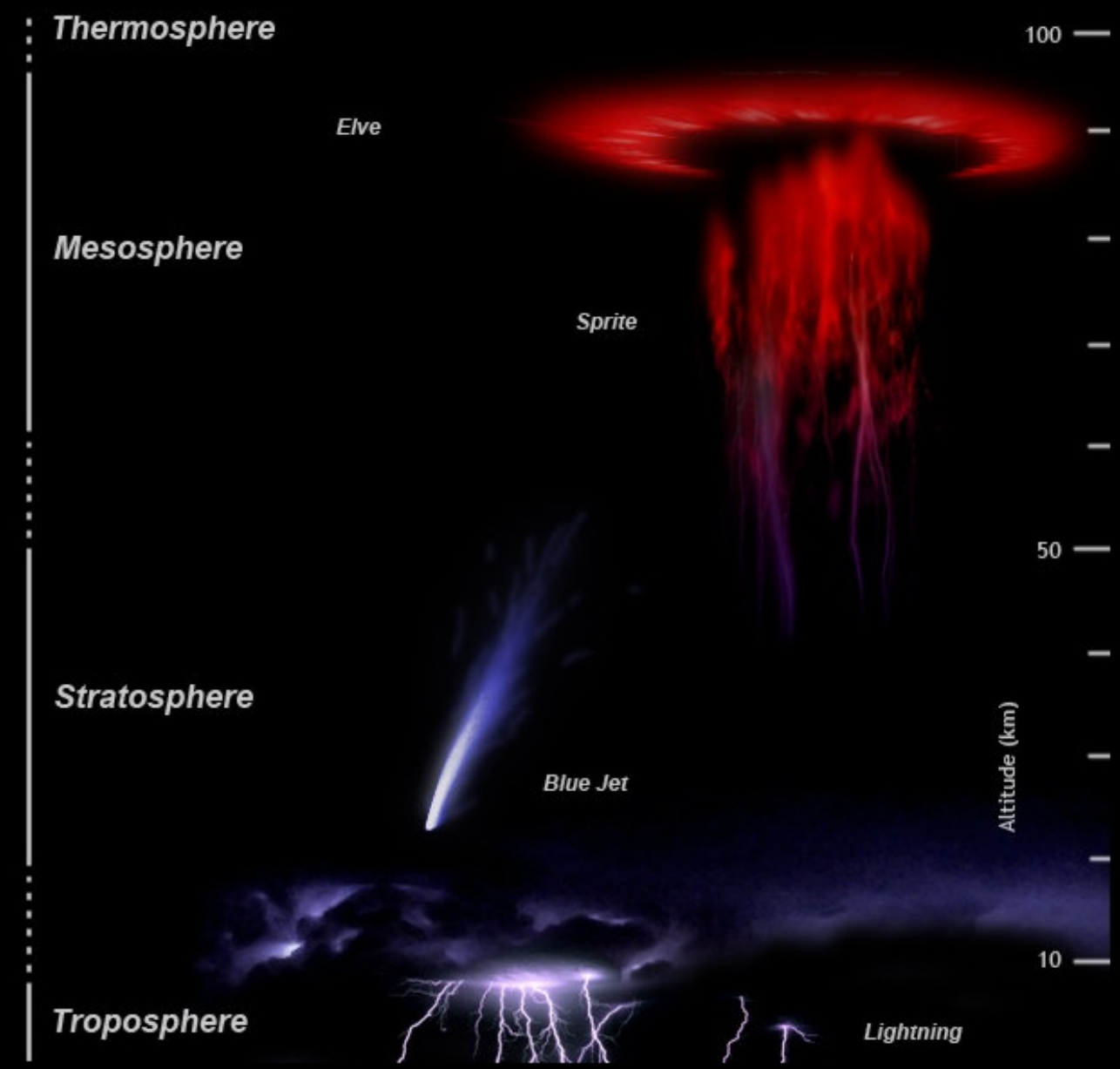


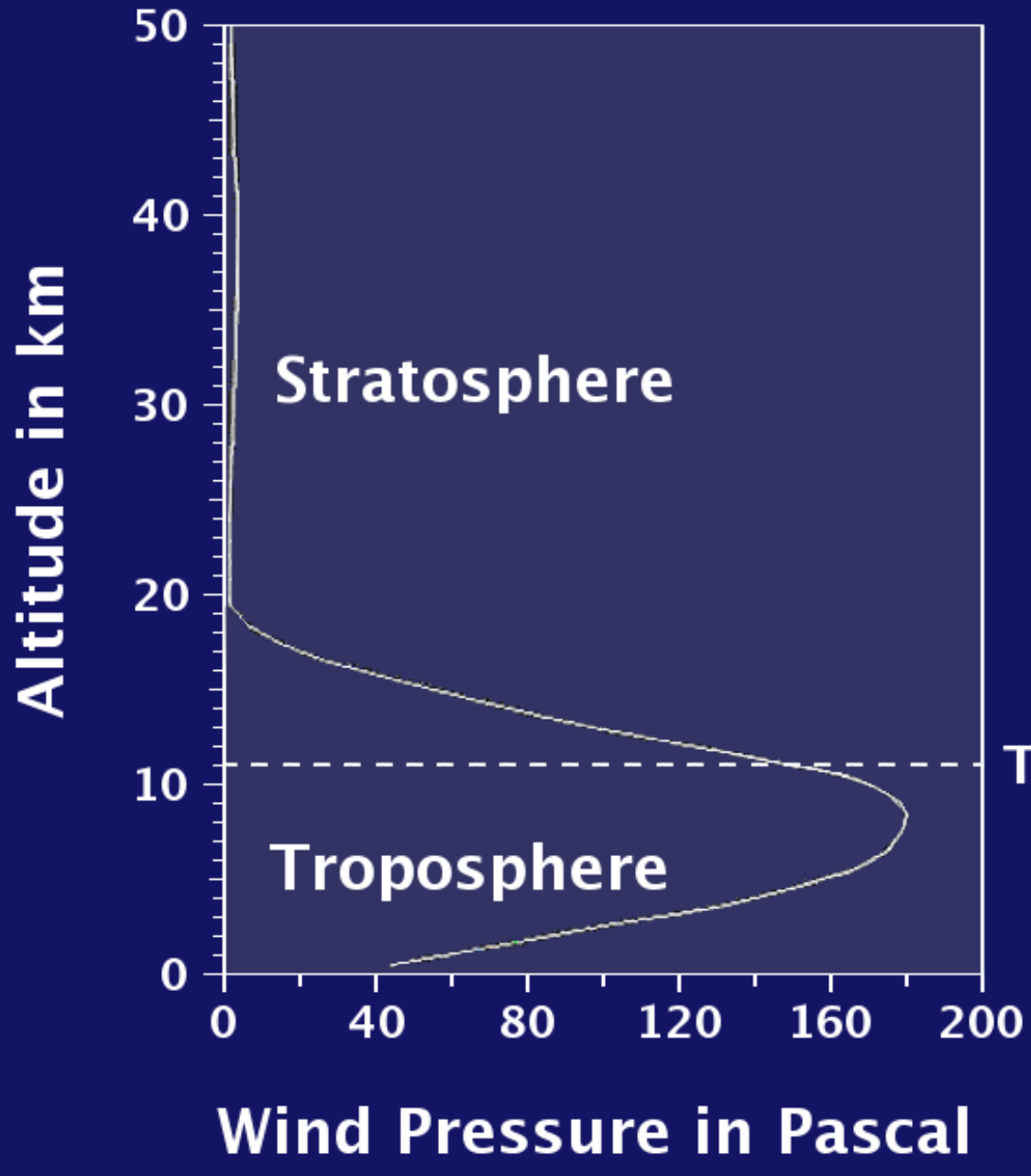


N298AG

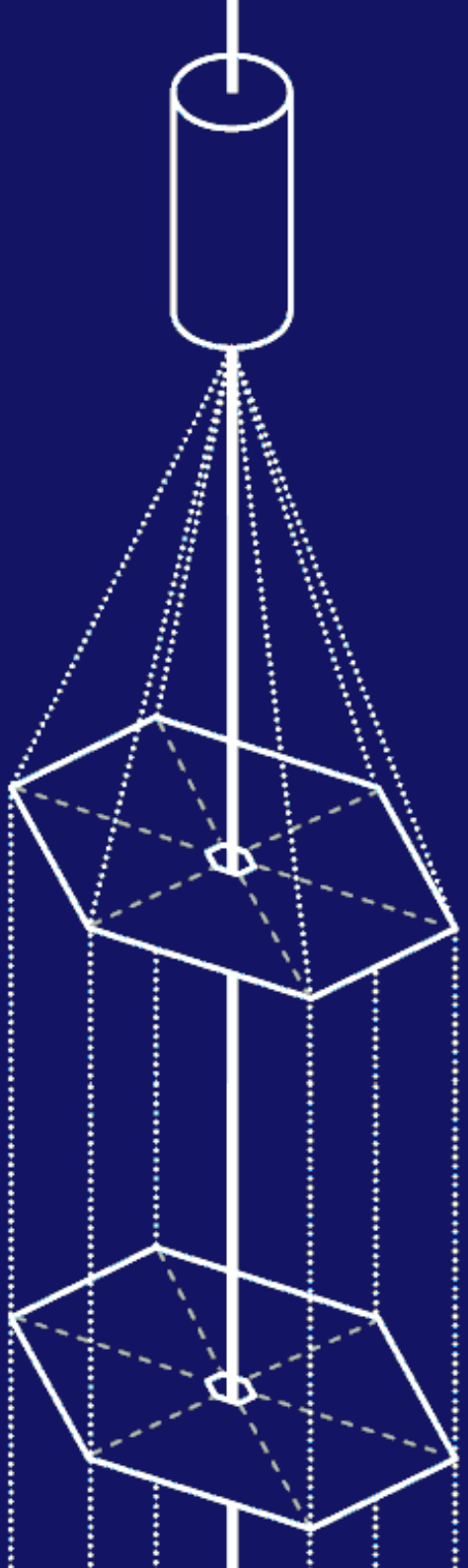




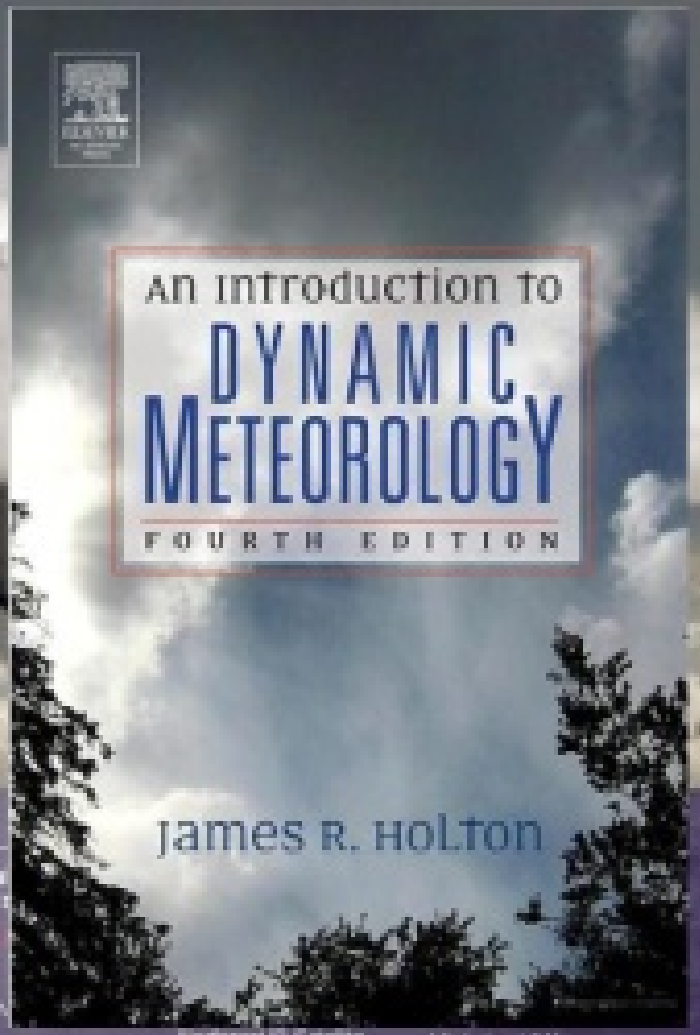

Thermosphere
Elve
Mesosphere
Sprite
Stratosphere
Blue Jet
Troposphere
Lightning
100
50
10
Altitude (km)



Wind Pressure =
Density ×
Wind Speed ^{2}



Department of Atmospheric Sciences



Explore Atmospheric Sciences

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Courses

Research
Overview
Research Highlights
Areas of Research

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K-12 Outreach
AMS Student Chapter

Alumni & Friends
Giving
Endowed Lectures

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UW Forecast

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Planning a Visit

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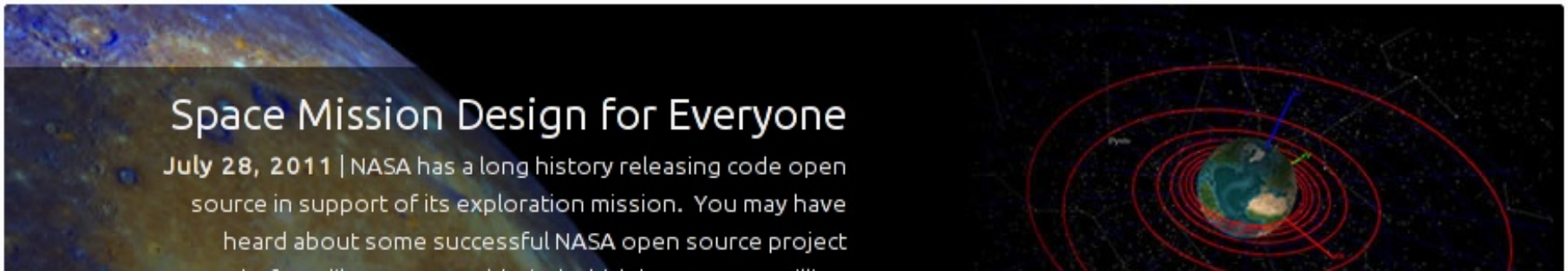
The launch of open.nasa.gov

July 28, 2011 | We are very excited to launch open.nasa.gov - a collaborative platform for the open government community to share success stories and projects they are working on. The content on this site is written by NASA employees and contractors. We are excited

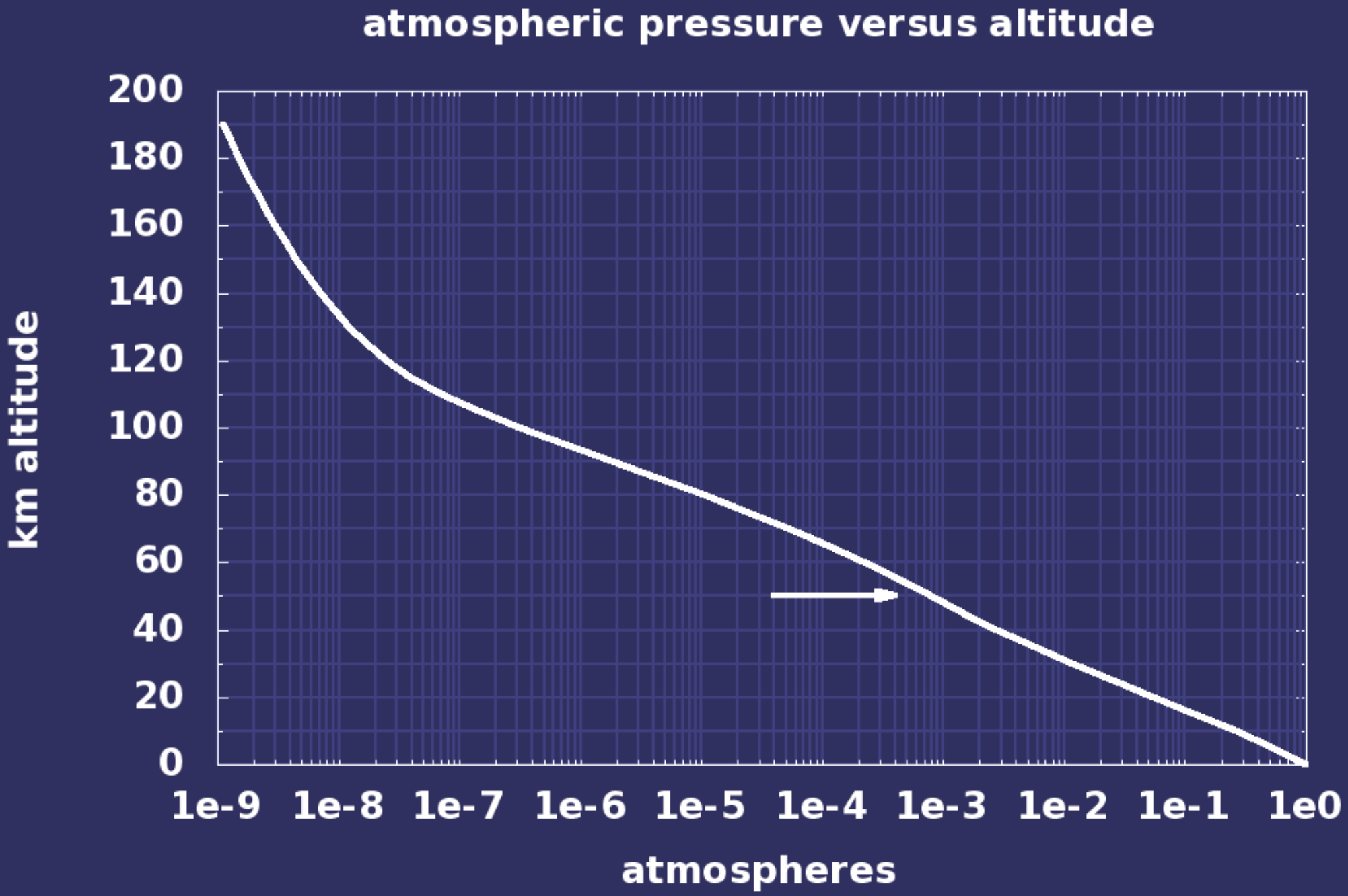
Read more

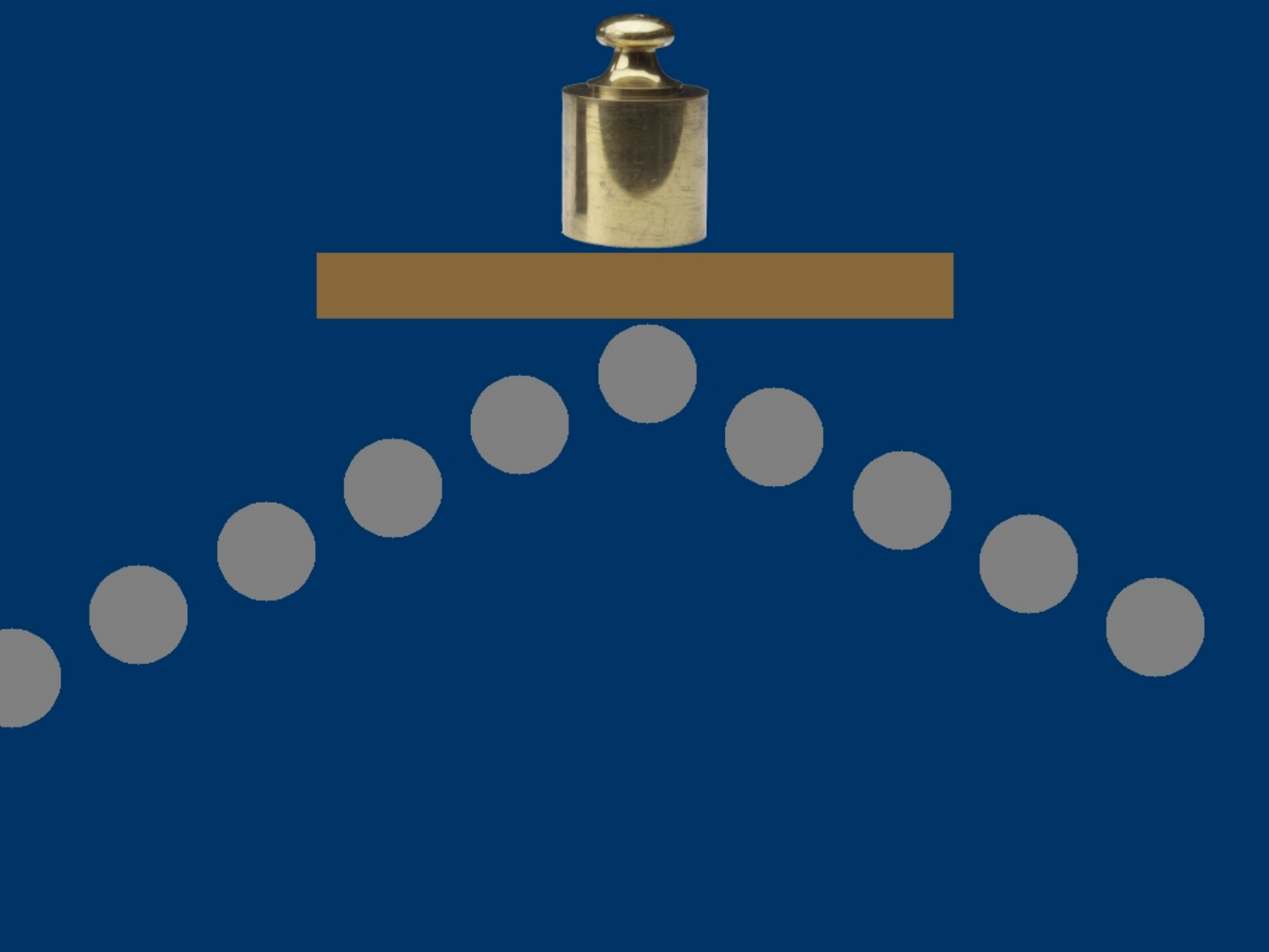
PUBLISHING THE OPEN SOURCE WAY



Space Mission Design for Everyone

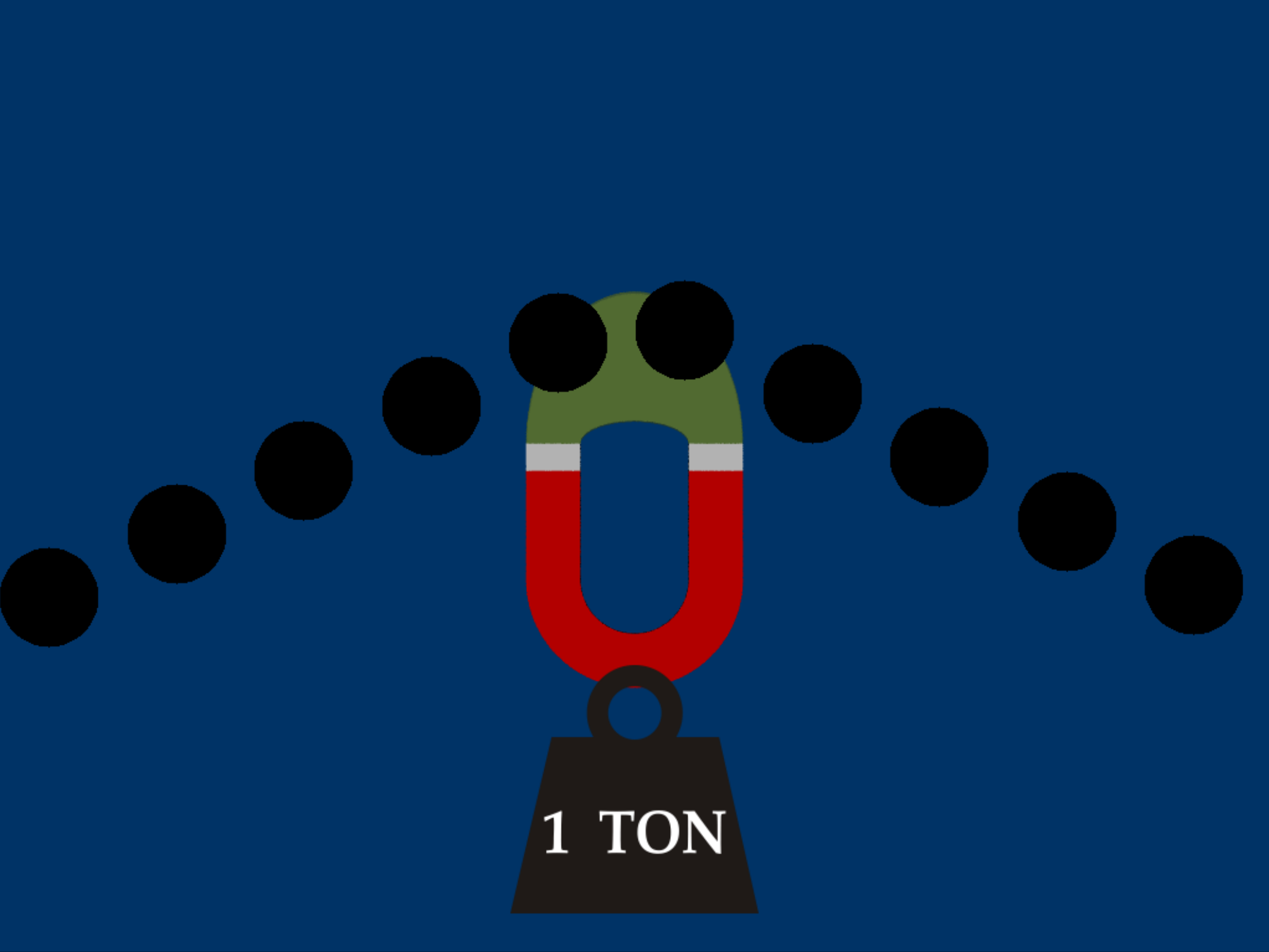
July 28, 2011 | NASA has a long history releasing code open source in support of its exploration mission. You may have heard about some successful NASA open source project


atmospheric pressure versus altitude
km altitude
200
180
160
140
120
100
80
60
40
20
0
1e-9
1e-8
1e-7
1e-6
1e-5
1e-4
1e-3
1e-2
1e-1
1e0
atmospheres



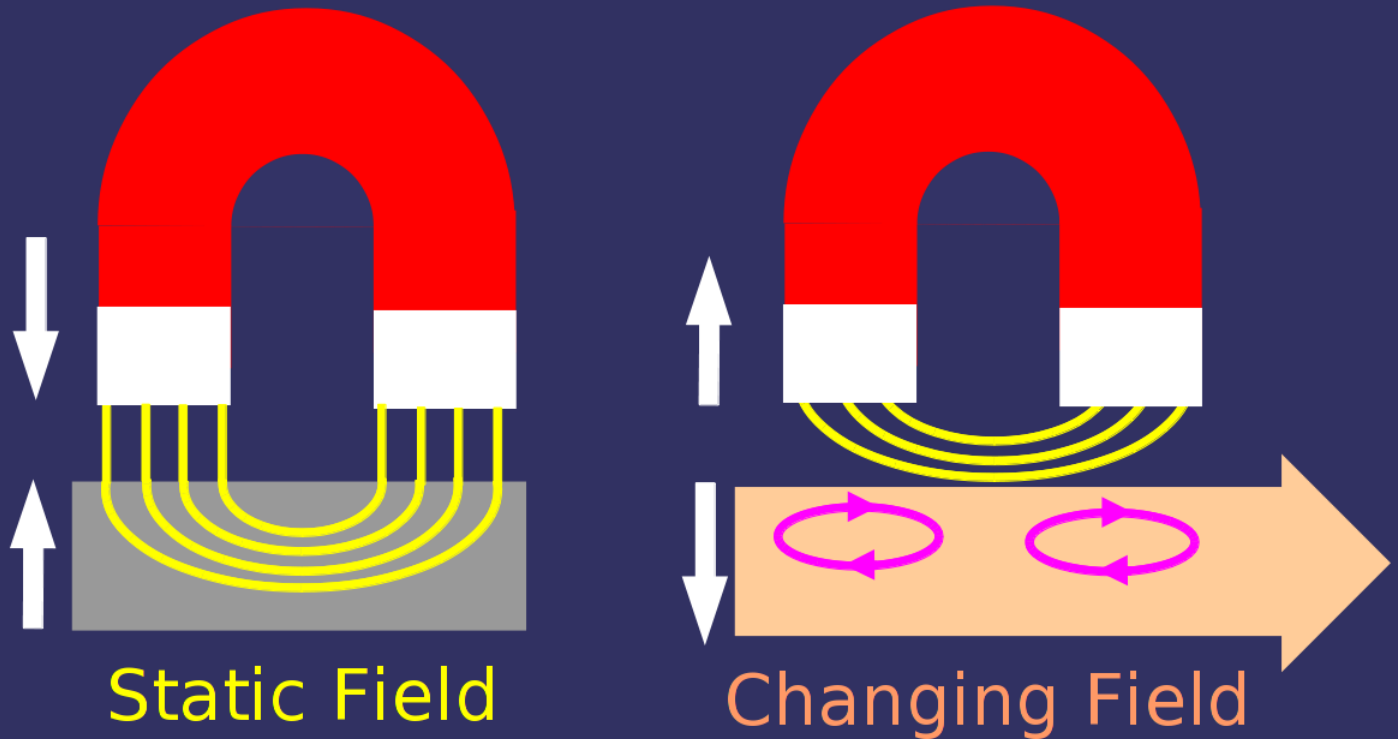
2x Velocity
4x Force

1 kg/m 100m/s
60 degrees
10,000N ~ 1ton@1gee


1 TON

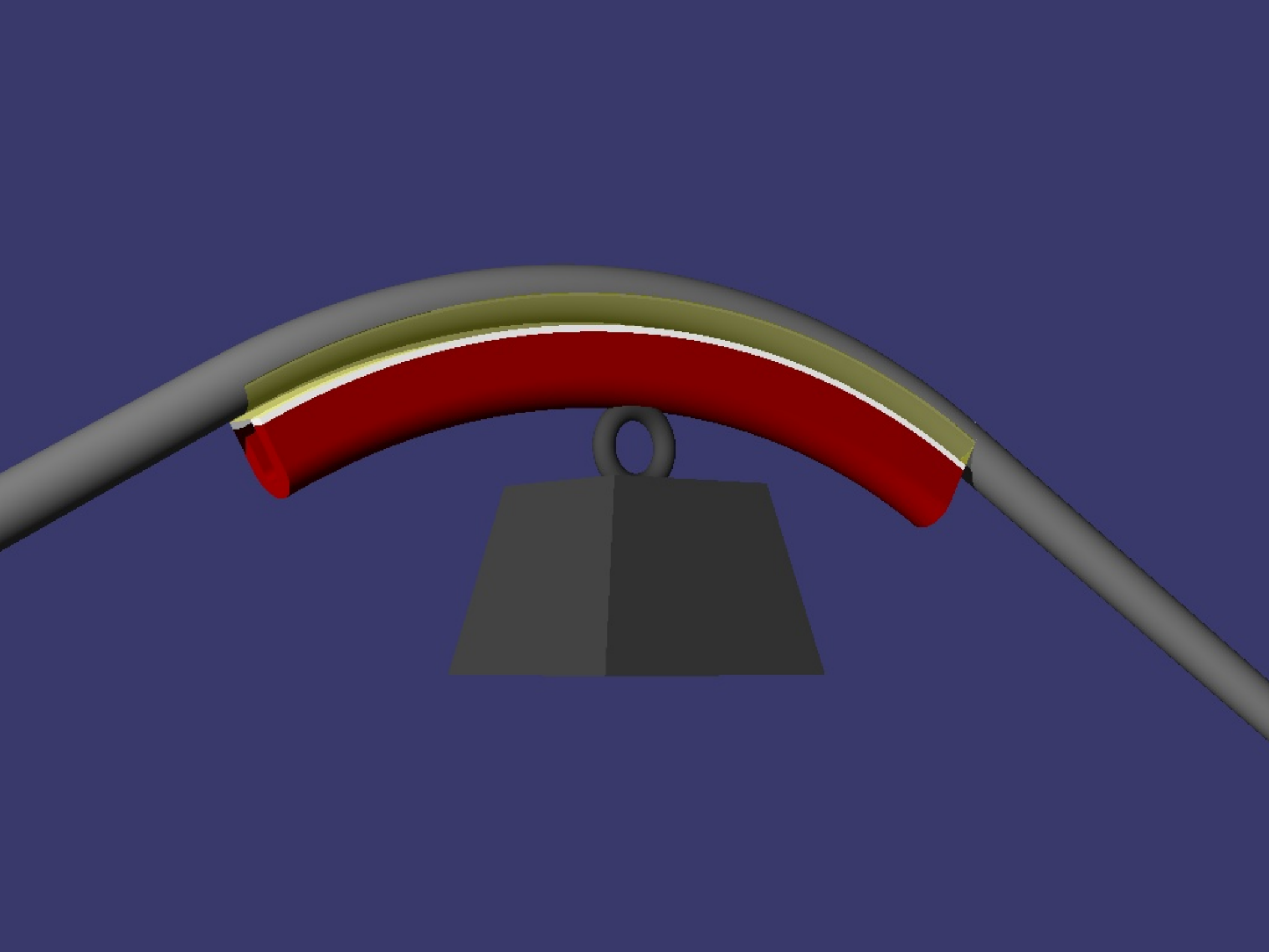
Magnetic Levitation

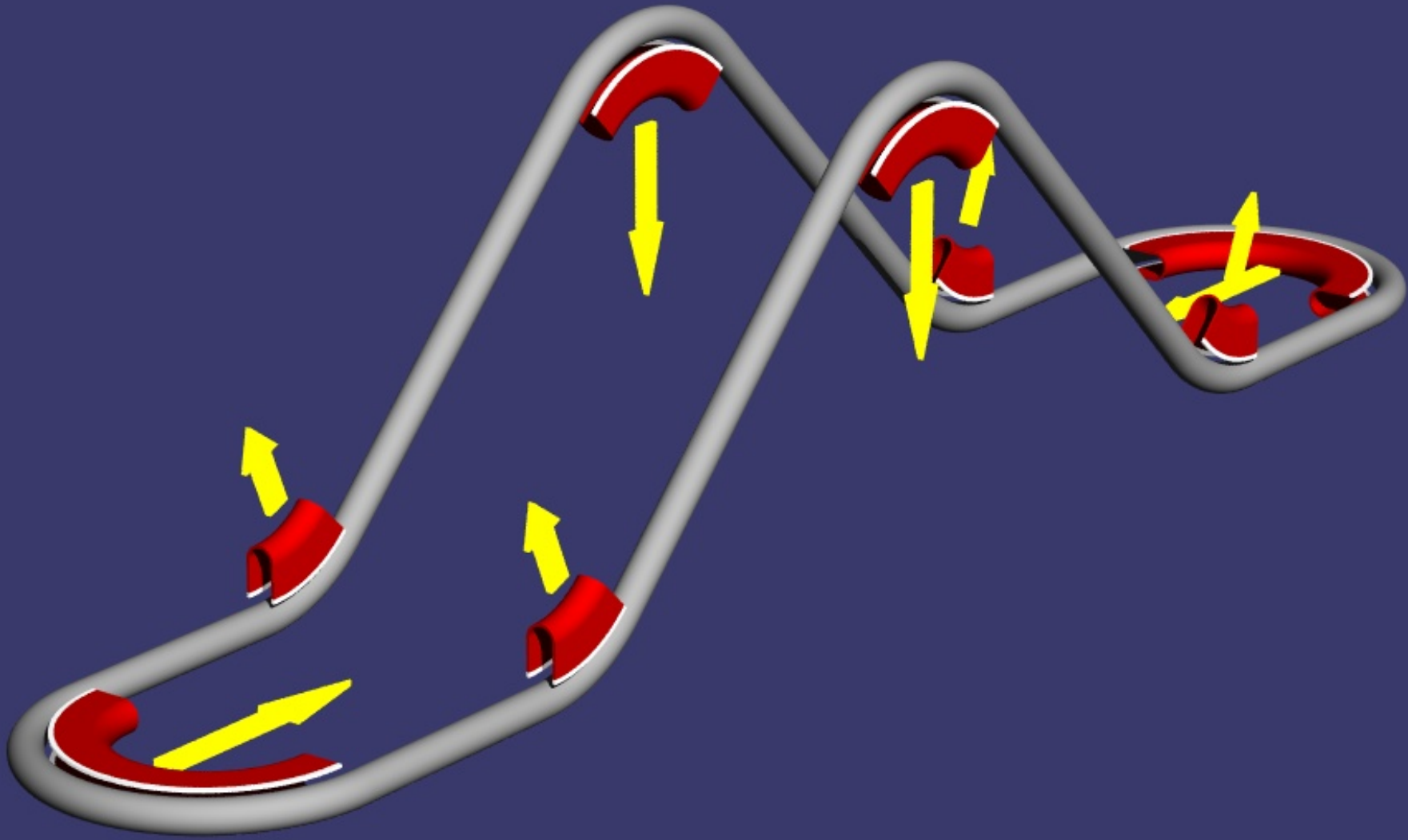
Attractive v.s. Repulsive

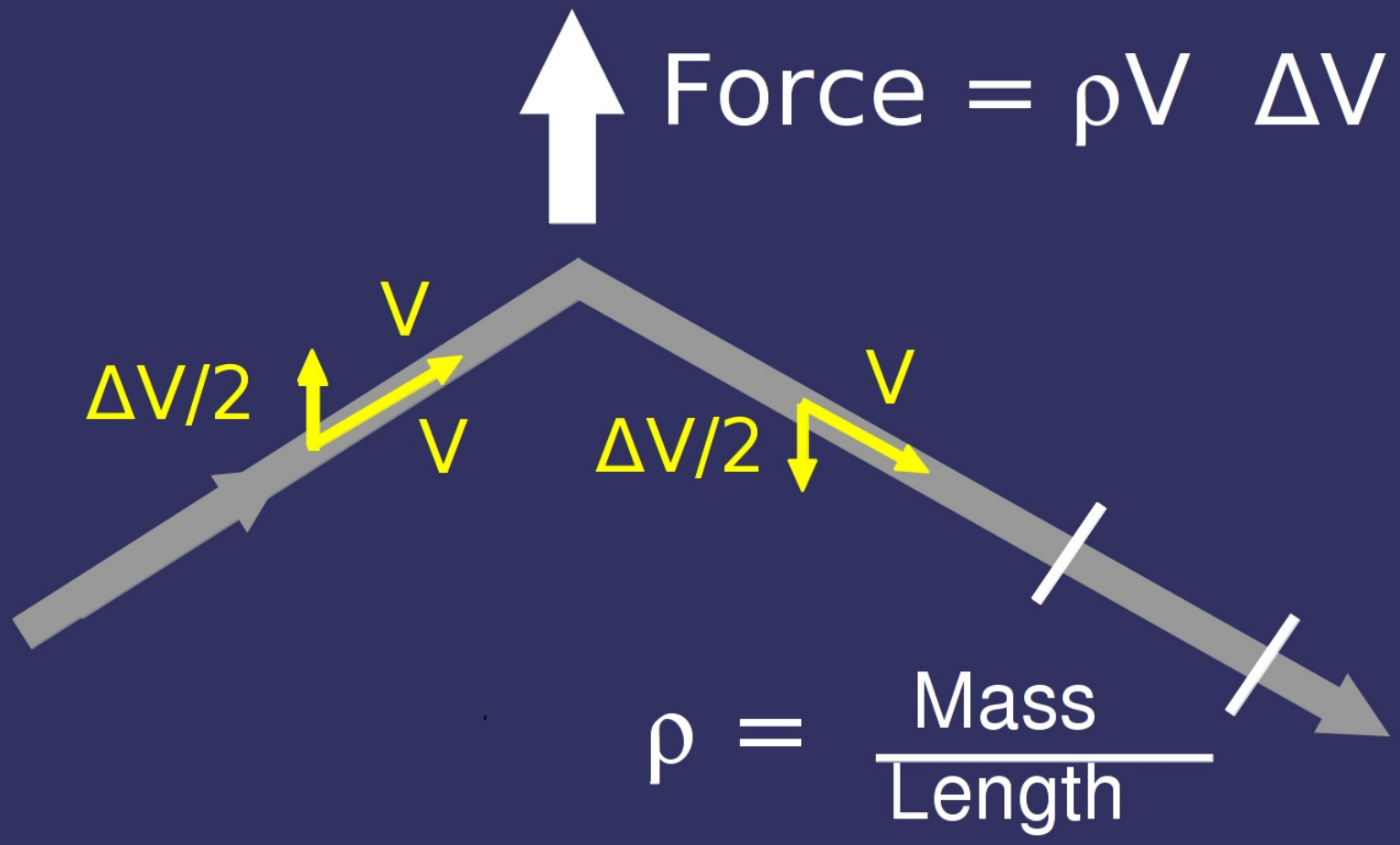


Static Field

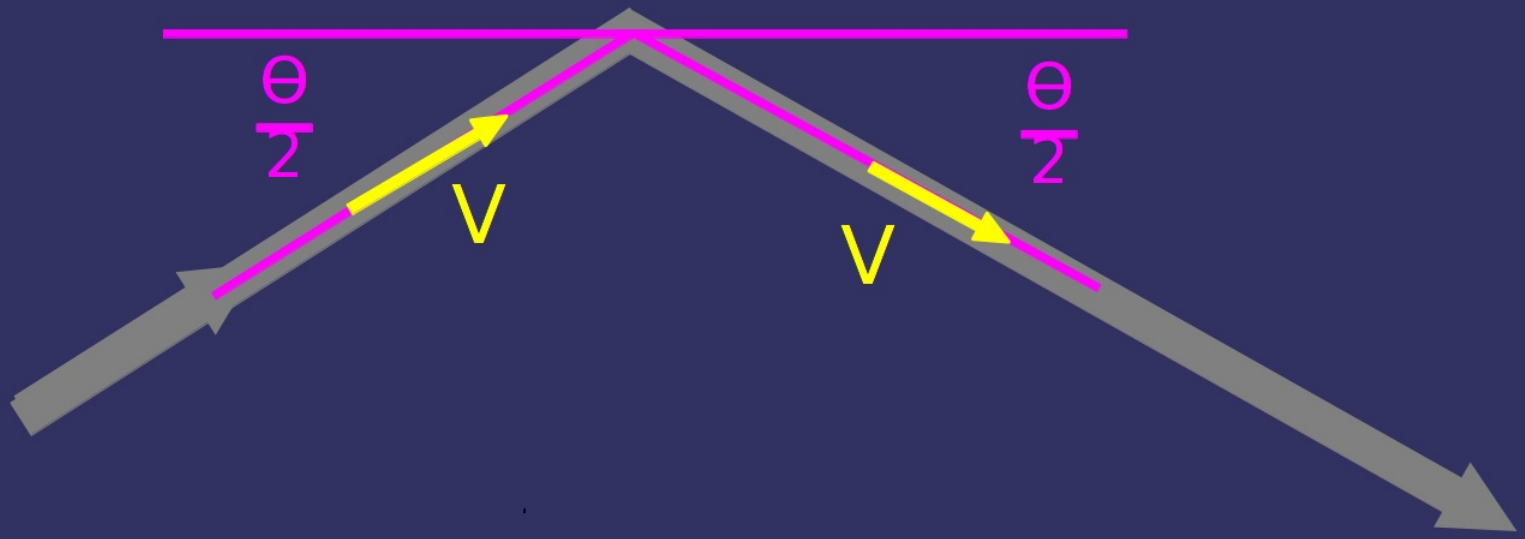
Changing Field






Force = ρV ΔV
V
ΔV/2
V
V
ΔV/2
ρ = Mass / Length

$$\text{Force} = 2\rho V^2 \sin\frac{\theta}{2}$$



$$\text{Force} = 2\rho V^2 \sin\frac{\theta}{2}$$

ρ = 3kg/m

V = 3500 m/s

θ = 10°	F= 6.4MN	(660 tons)
θ = 45°	F=28.1MN	(2900 tons)
θ = 180°	F=73.5MN	(7600 tons)

$$\text{Force} = 2\rho V^2 \sin\frac{\theta}{2}$$

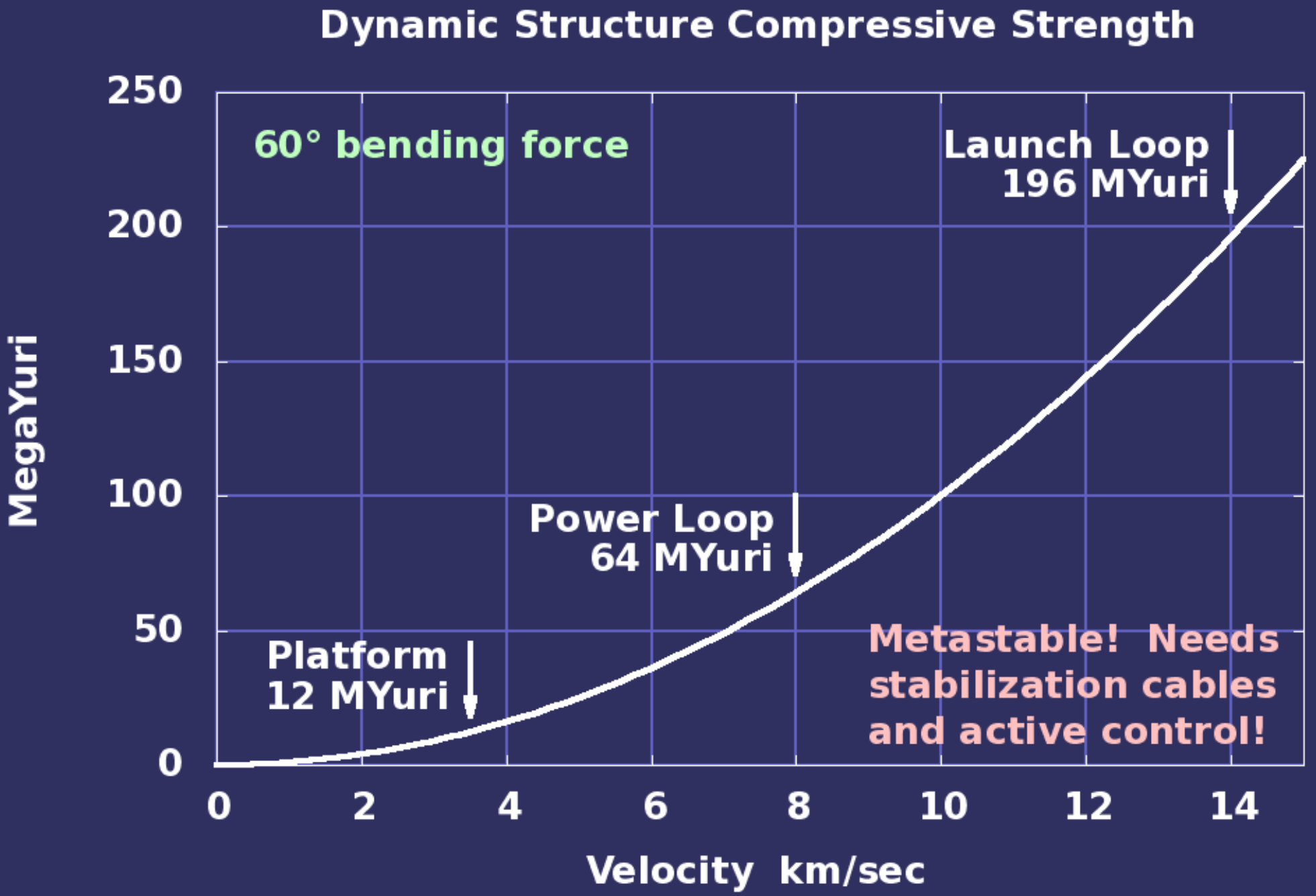
$\rho = 3\text{kg/m}$

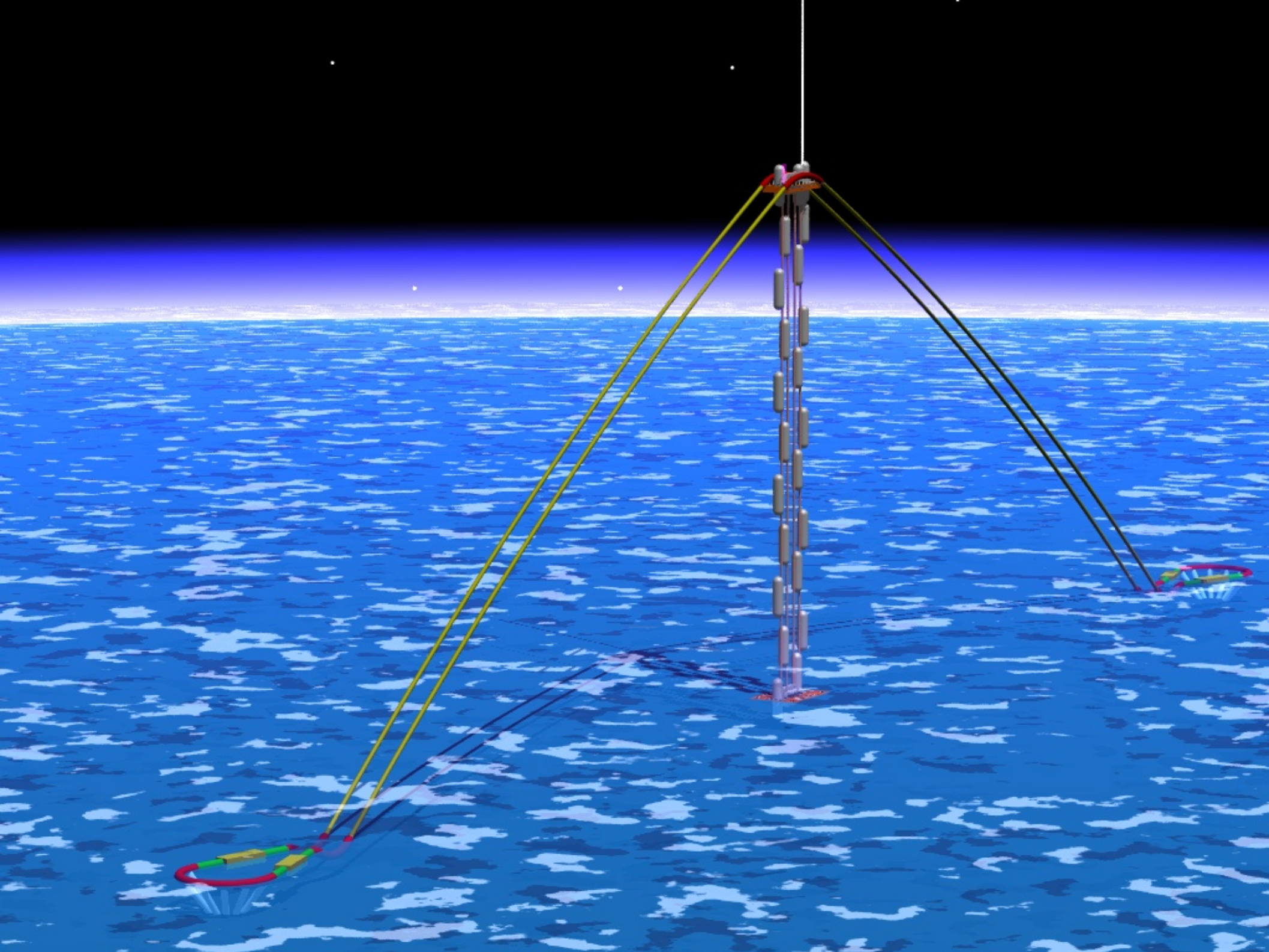
$V = 3500\ \text{m/s}$

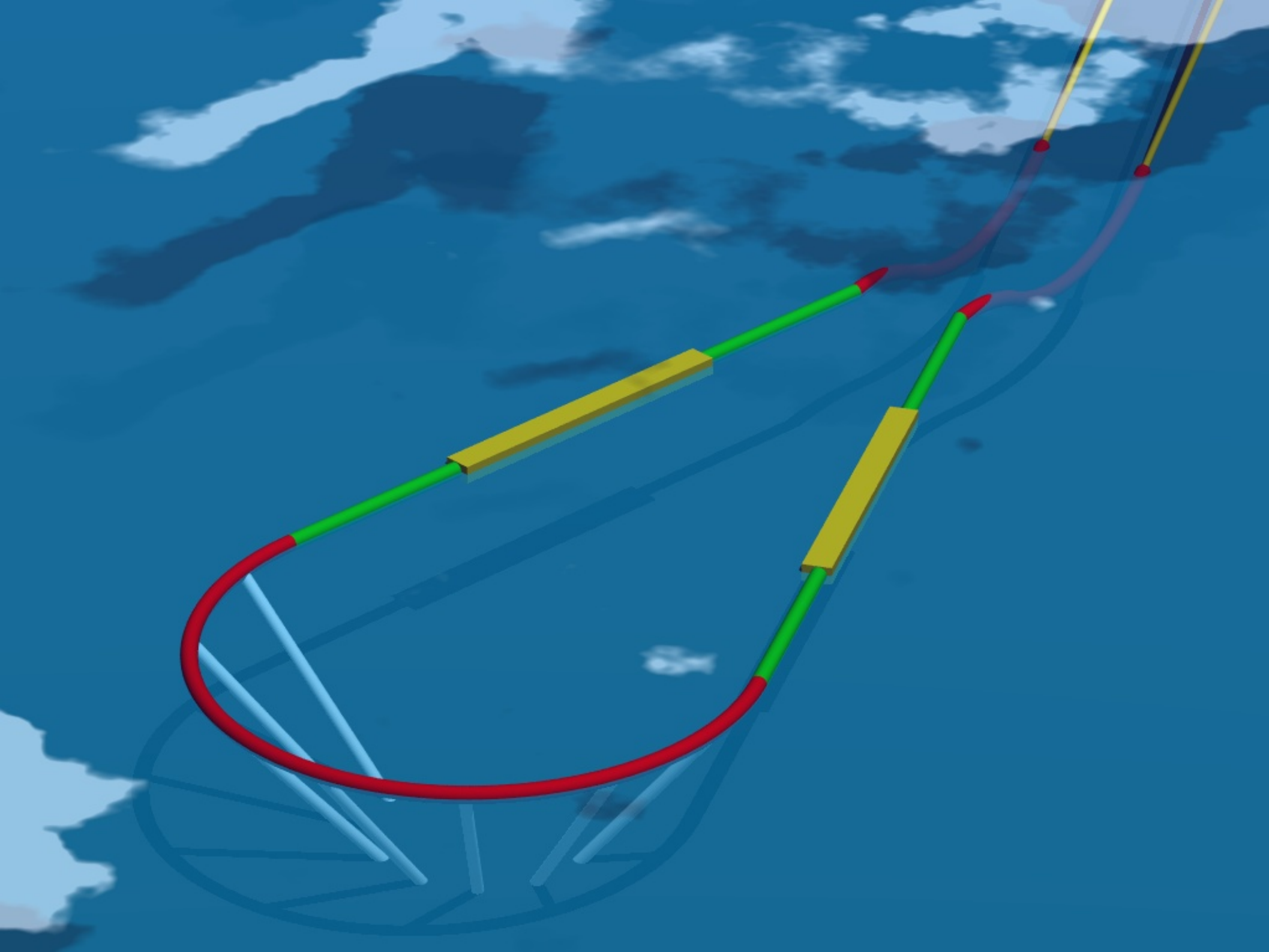
$\theta =$	10°	F= 6.4MN (660 tons)
$\theta =$	45°	F=28.1MN (2900 tons)
$\theta =$	180°	F=73.5MN (7600 tons)

$V^2 = 12e6\ m^2/s^2 \rightarrow 12$ MYuri

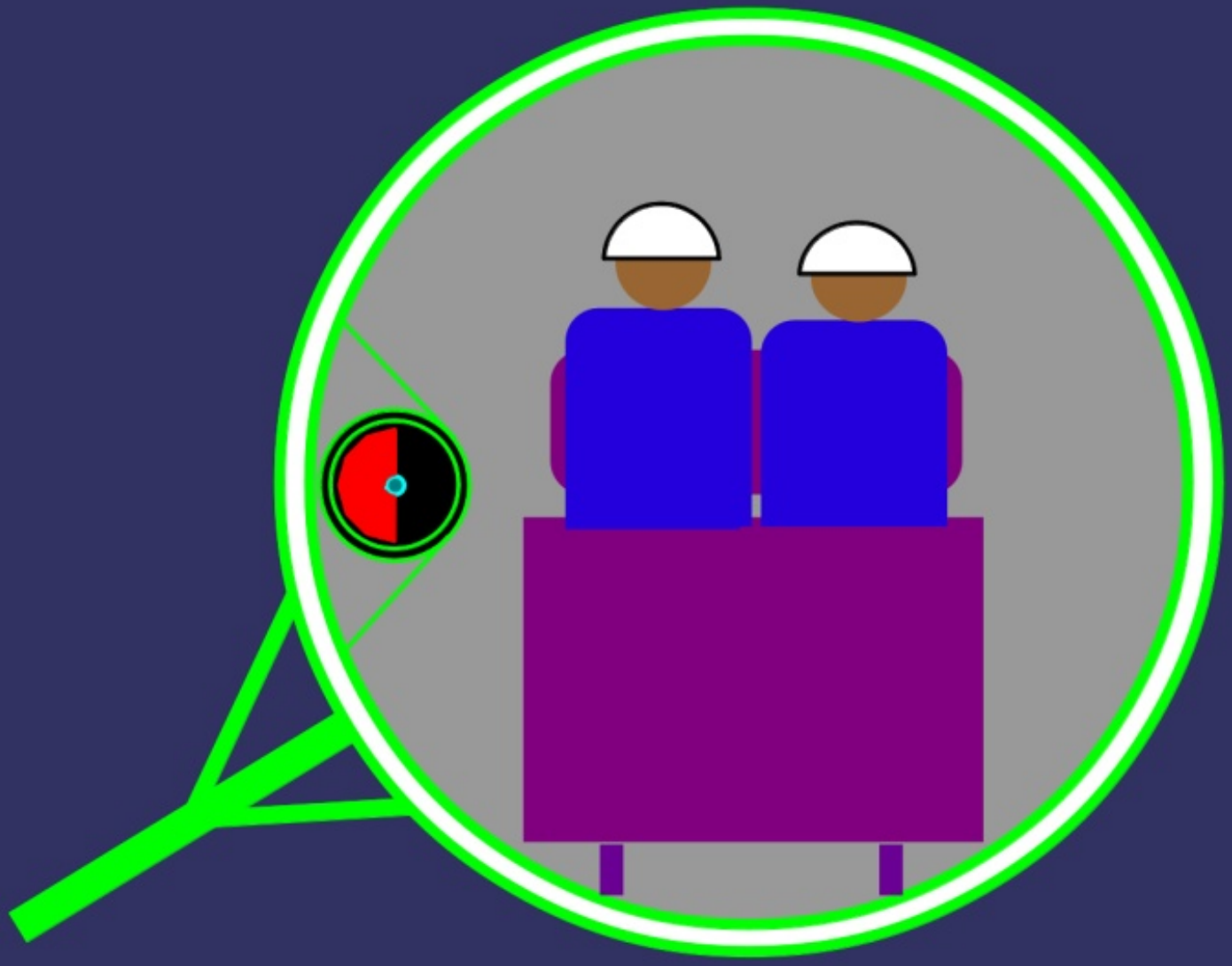
compression, not tension, metastable


Dynamic Structure Compressive Strength
250
200
150
100
50
0
MegaYuri
60° bending force
Launch Loop
196 MYuri
Power Loop
64 MYuri
Platform
12 MYuri
Metastable! Needs
stabilization cables
and active control!
0
2
4
6
8
10
12
14
Velocity km/sec

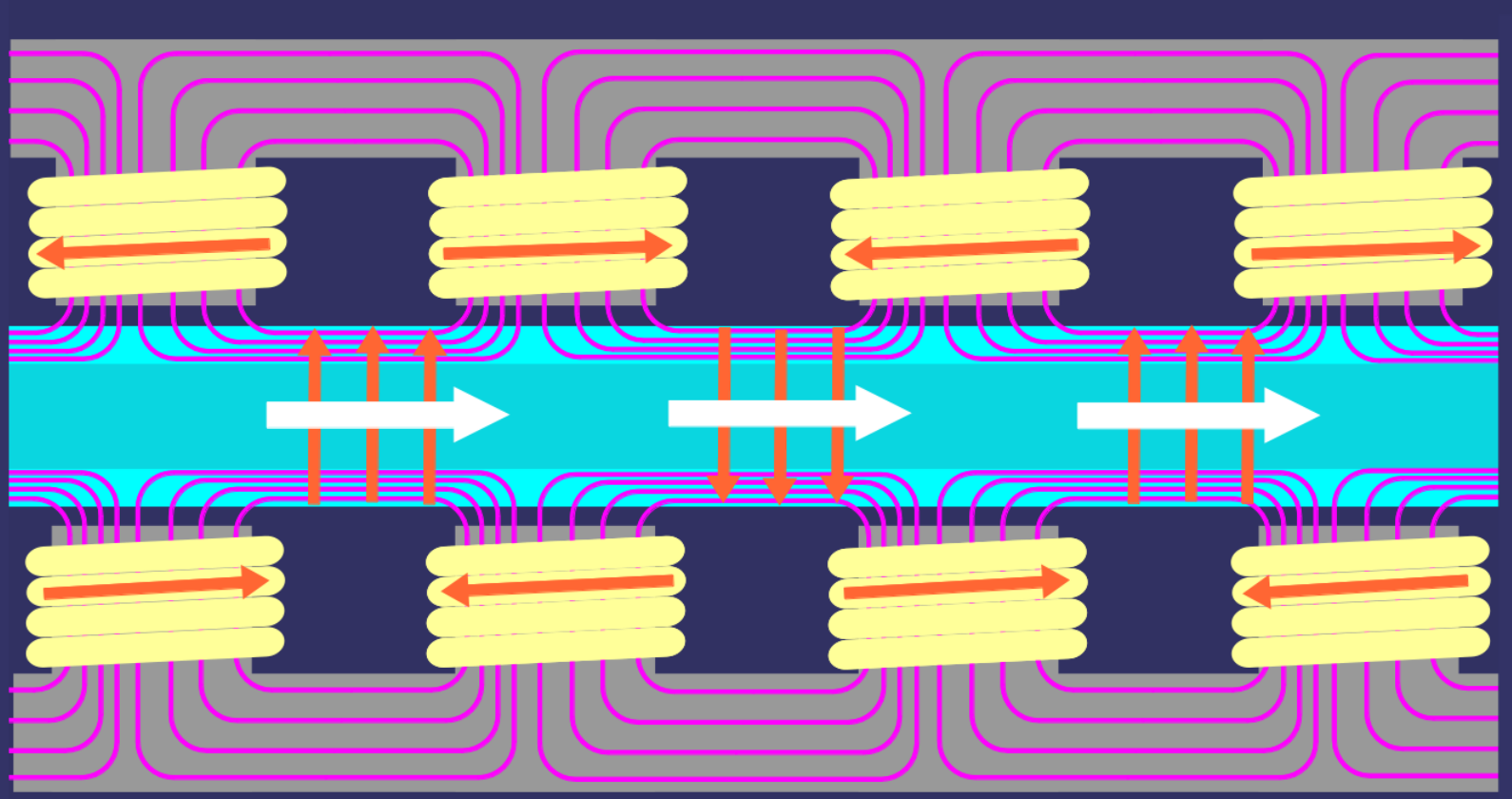




Ambit Cross Section

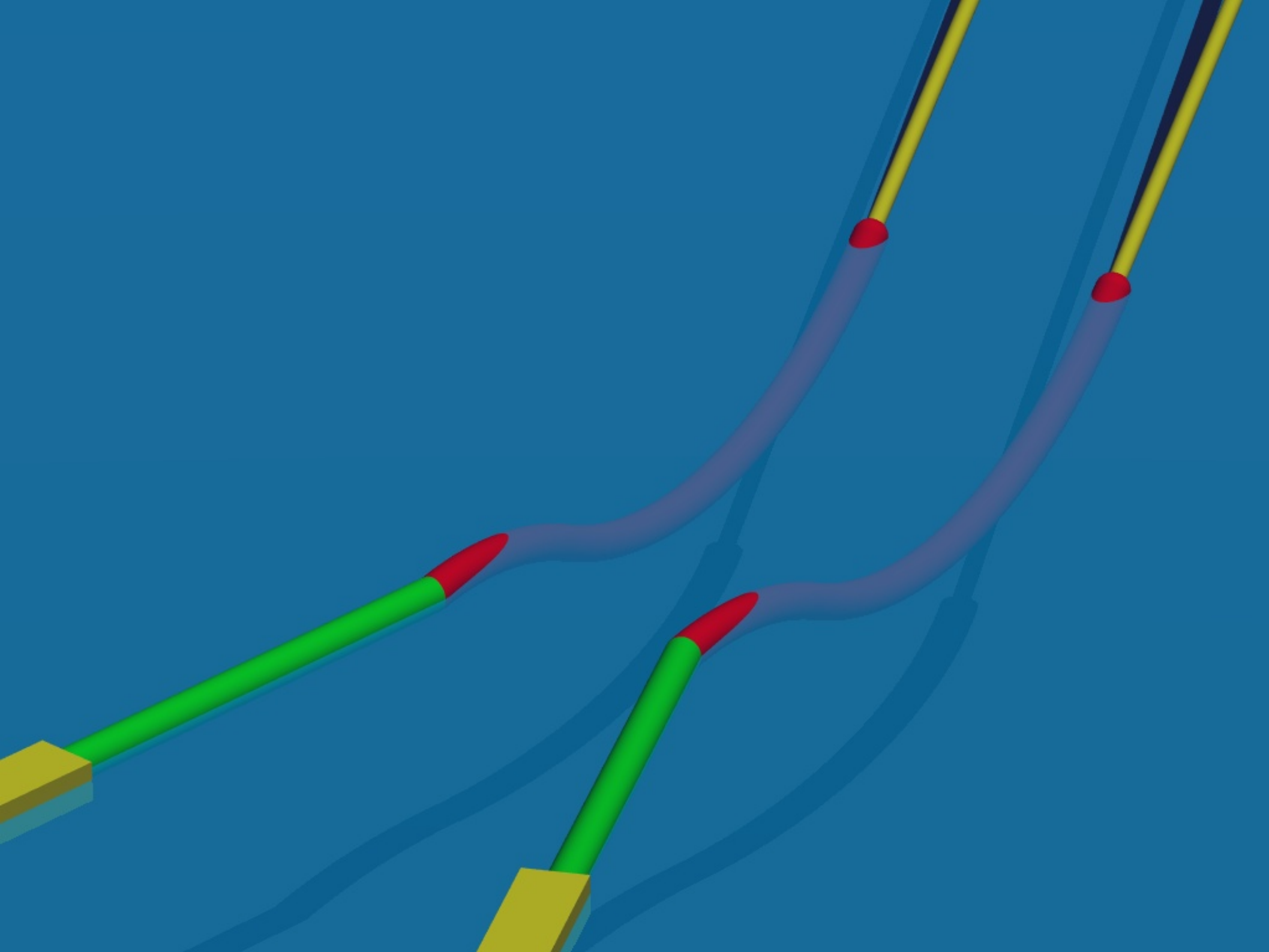


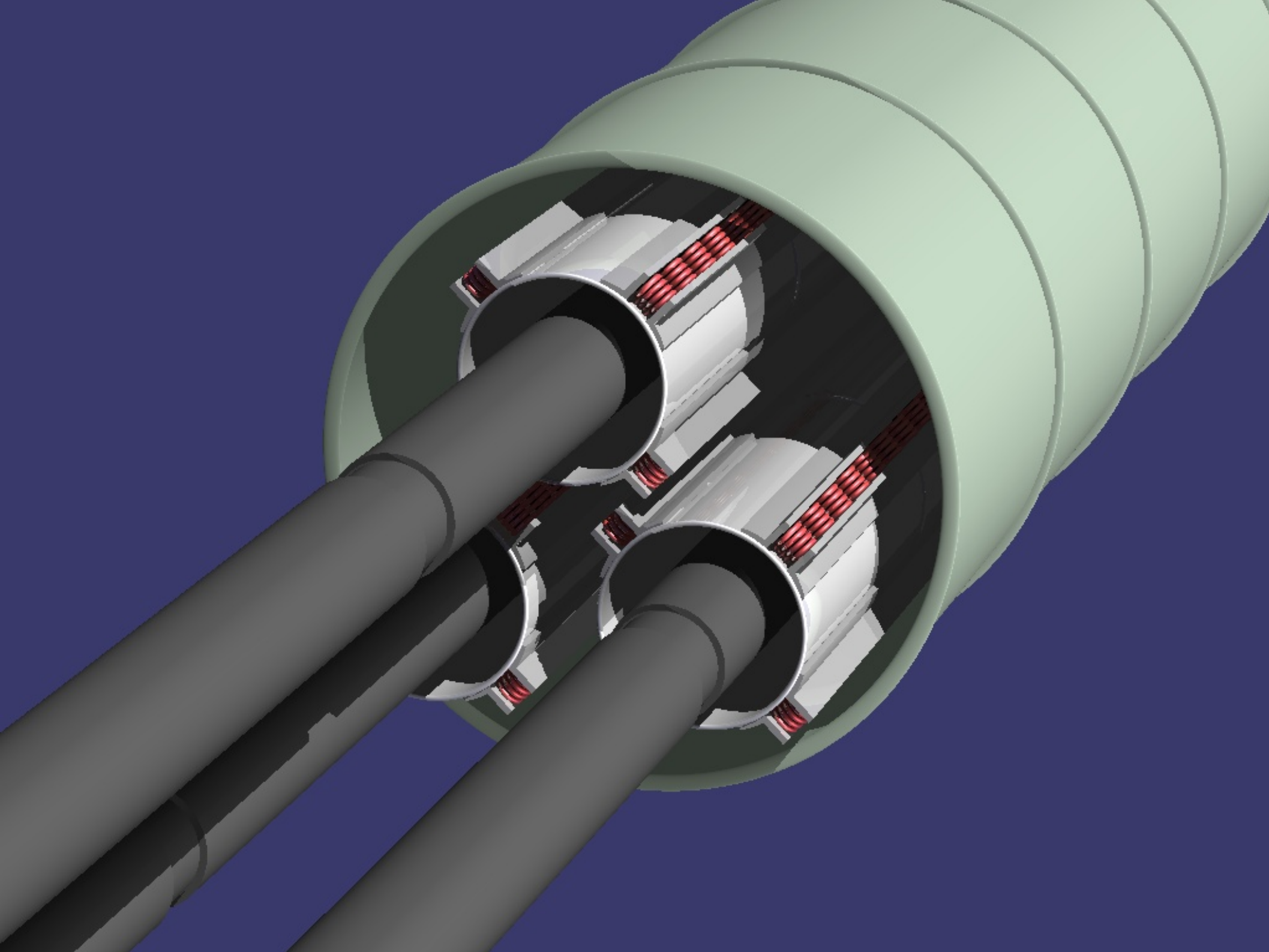
Linear Induction Motors

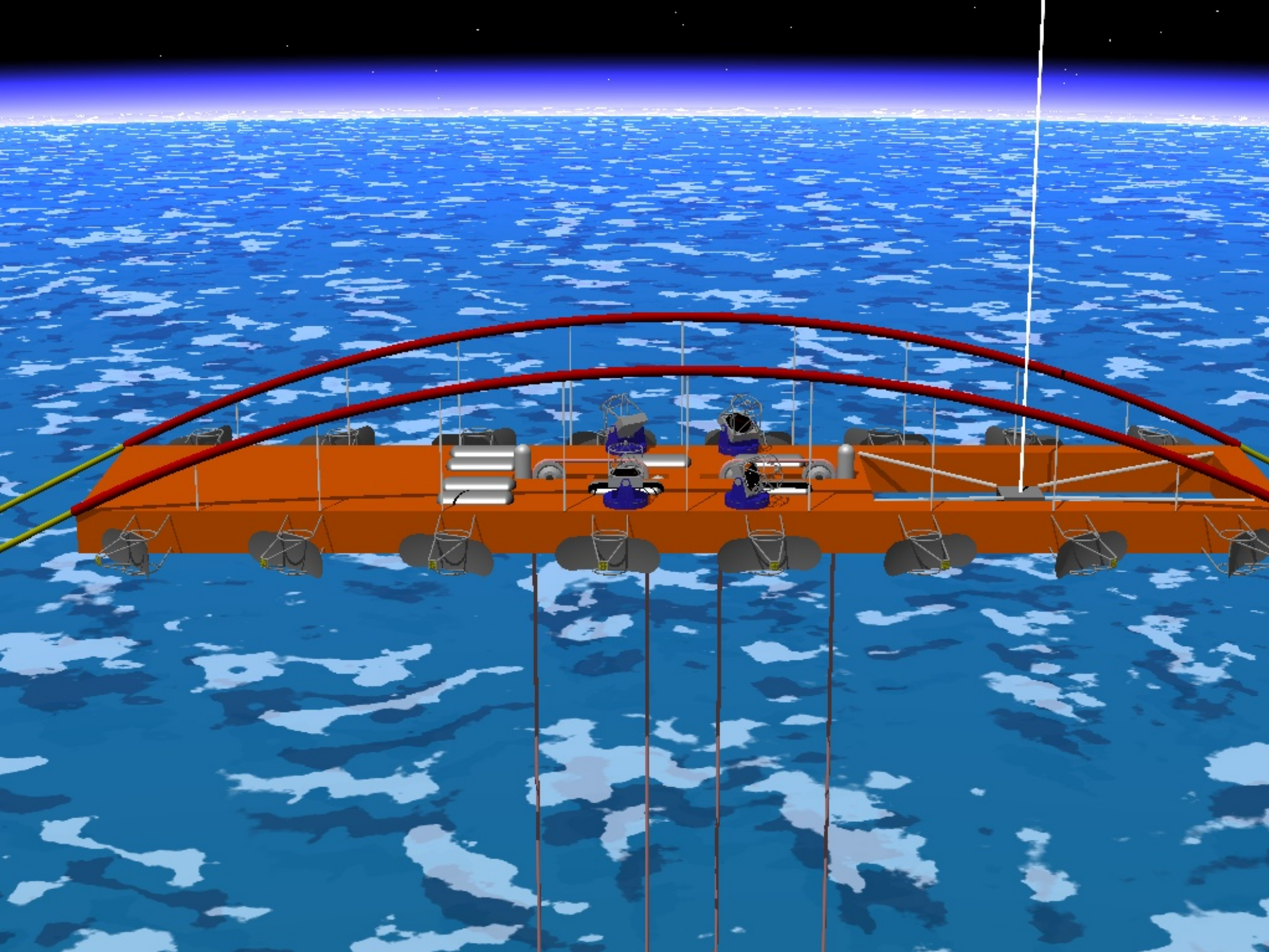


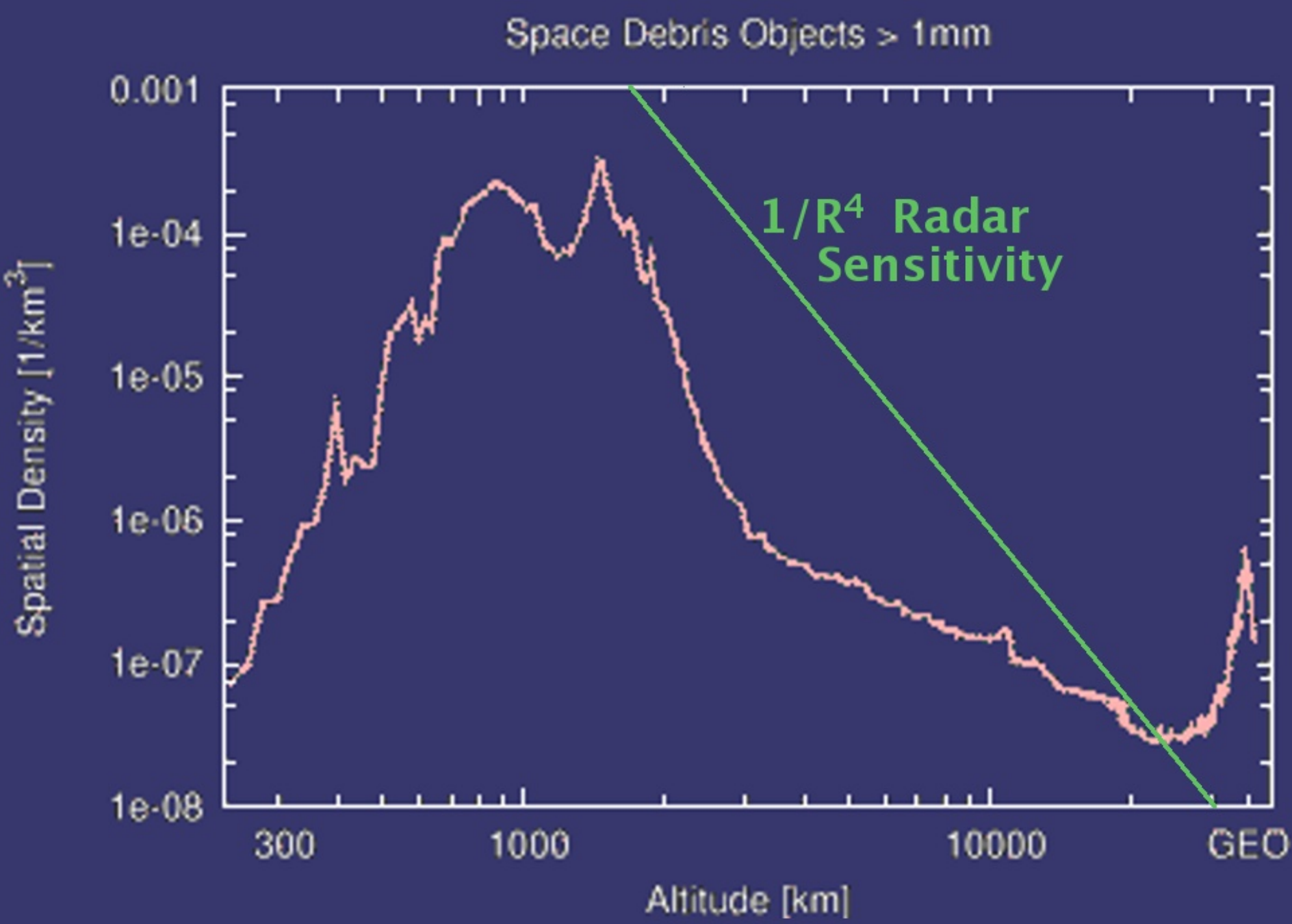
Losses ∝ Current^2 ∝ Force ∝ Power / Velocity

Losses ∝ 1 / Velocity



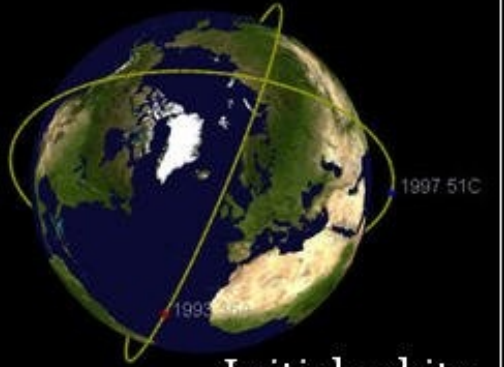





Space Debris Objects > 1mm
0.001
1e-04
1e-05
1e-06
1e-07
1e-08
Spatial Density [1/km³]
1/R⁴ Radar
Sensitivity
300
1000
10000
GEO
Altitude [km]

Collision of Iridium-33 with Cosmos-2251

Fragments ≥ 10 cm

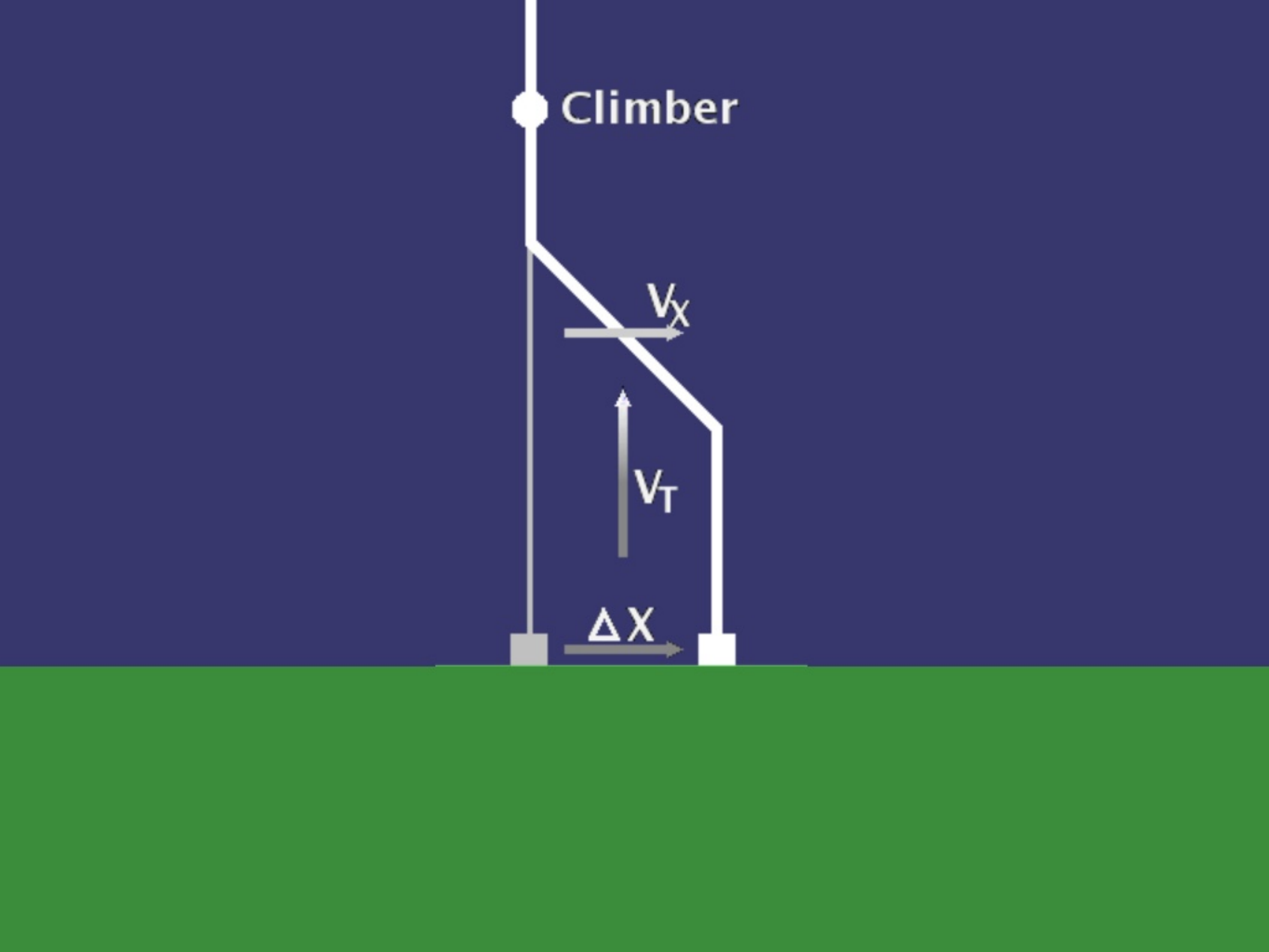


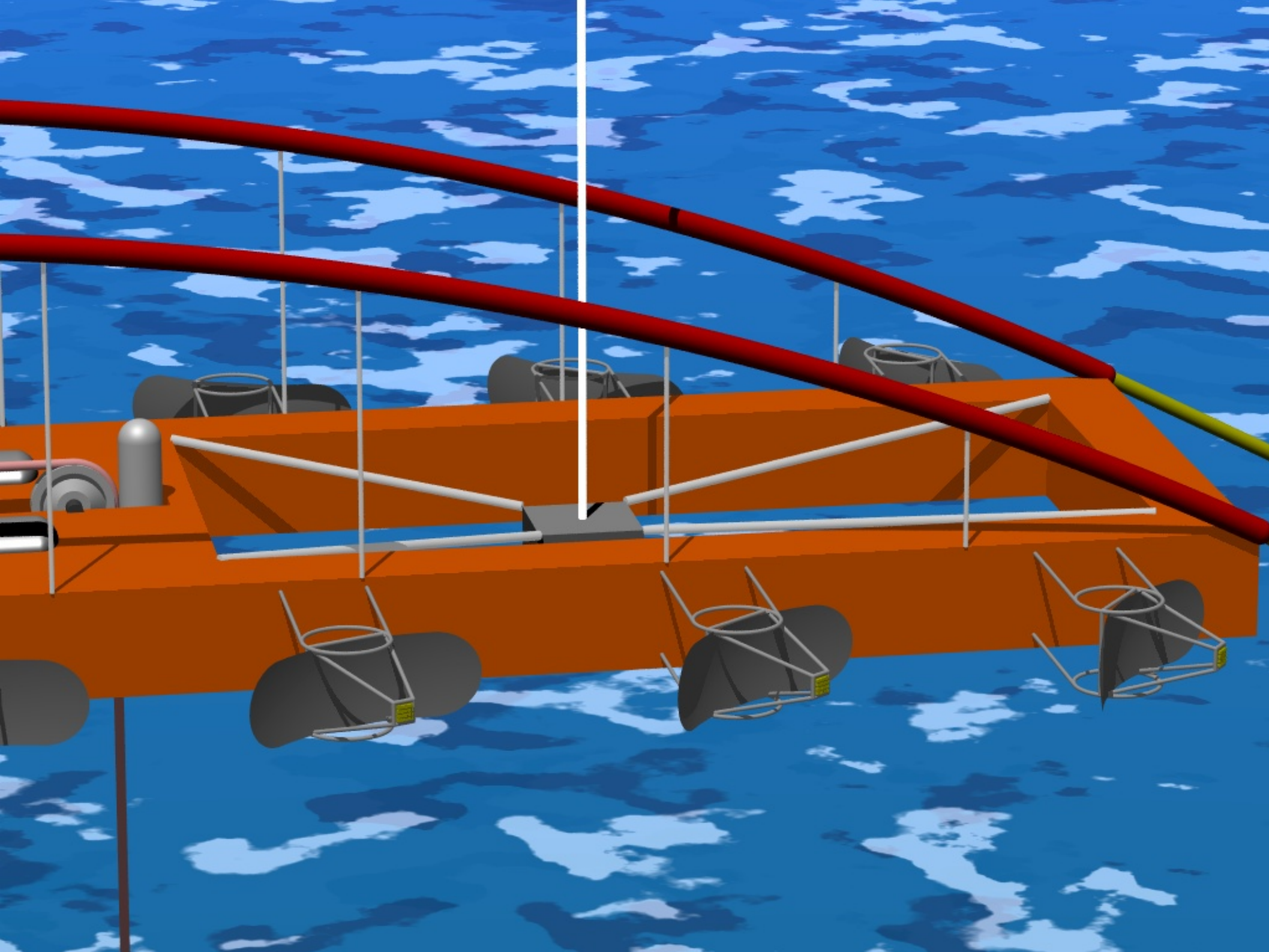
Initial orbits

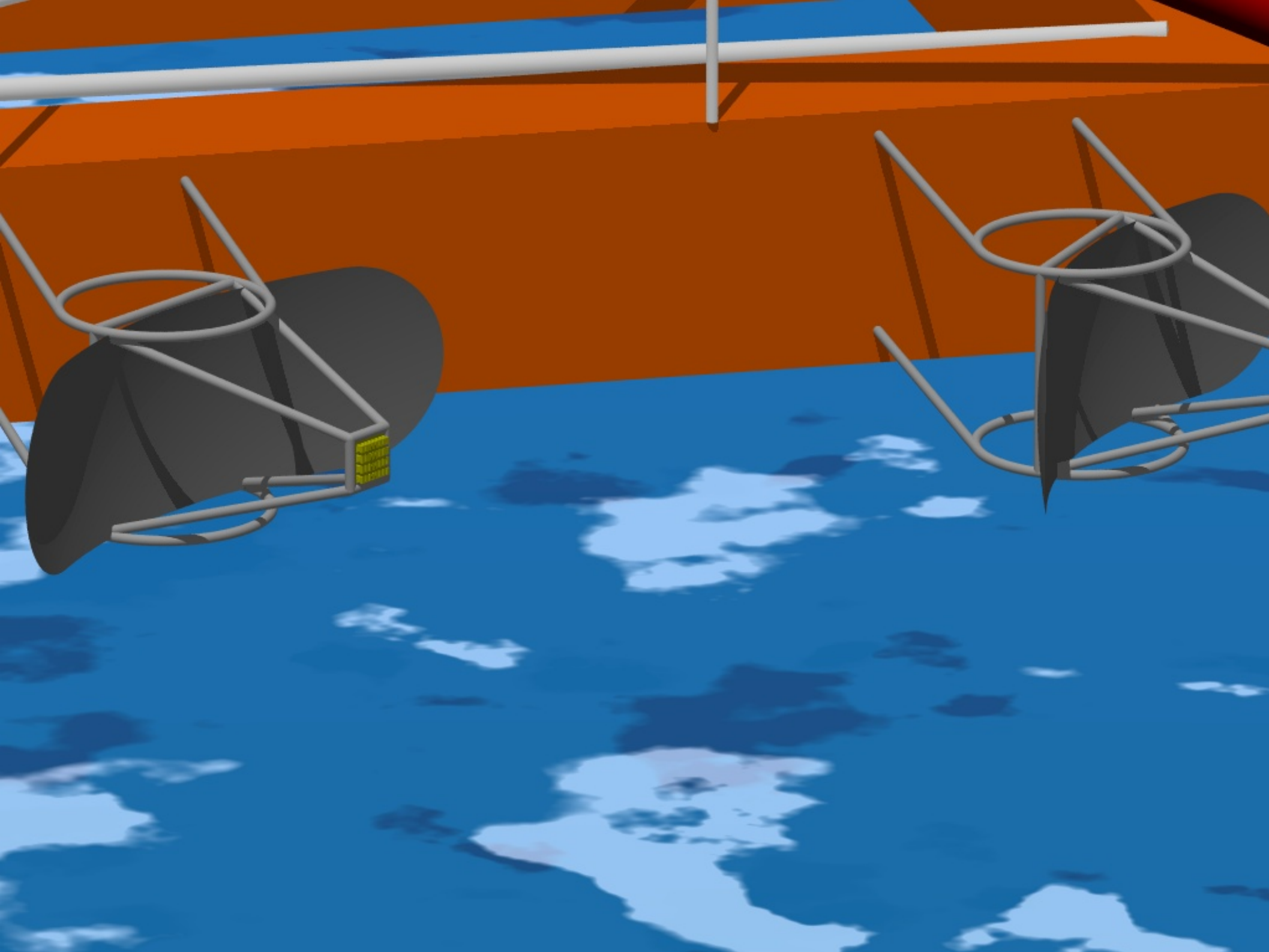
20 minutes after collision

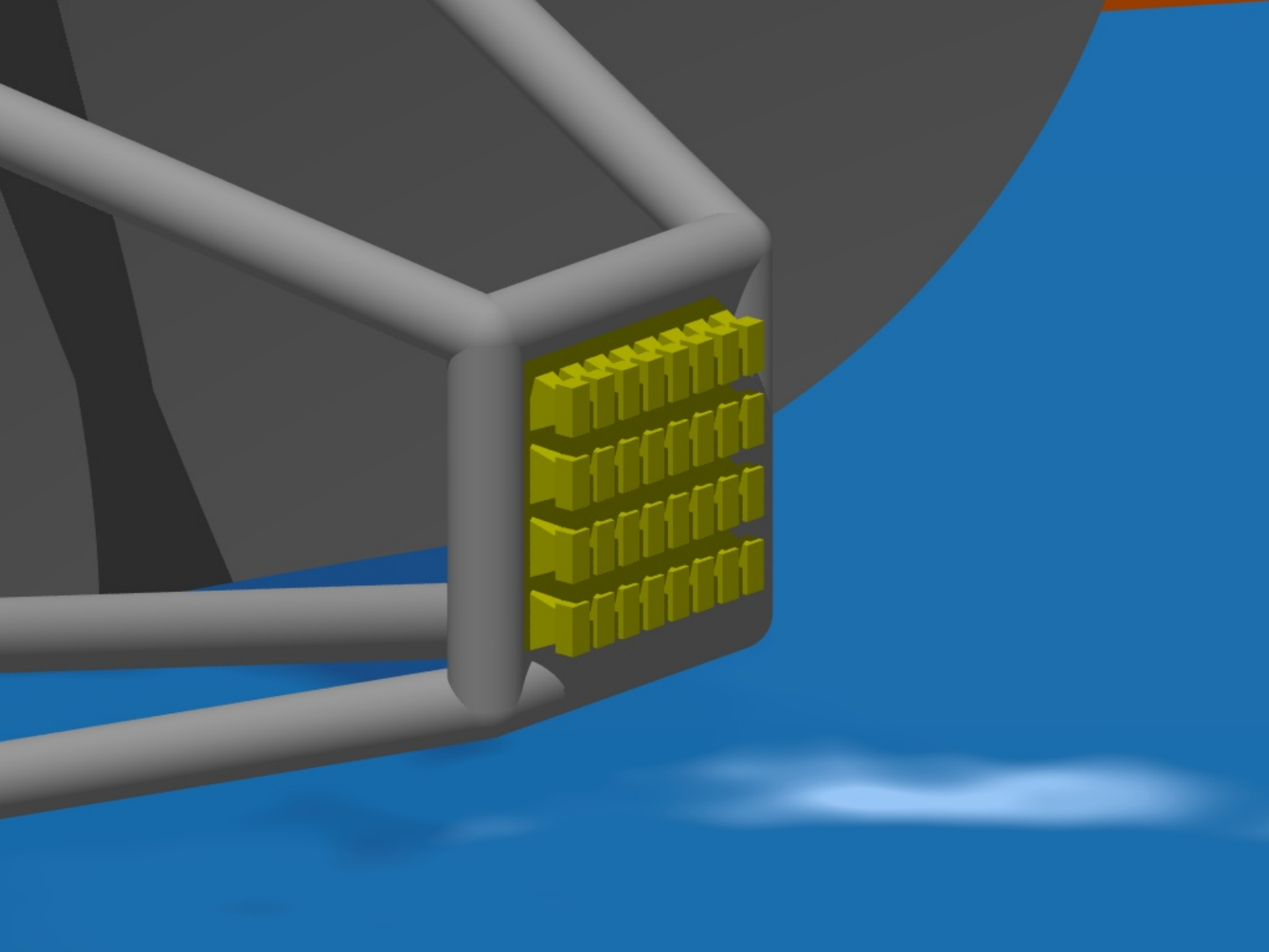
50 minutes after collision
(first pass over South pole)

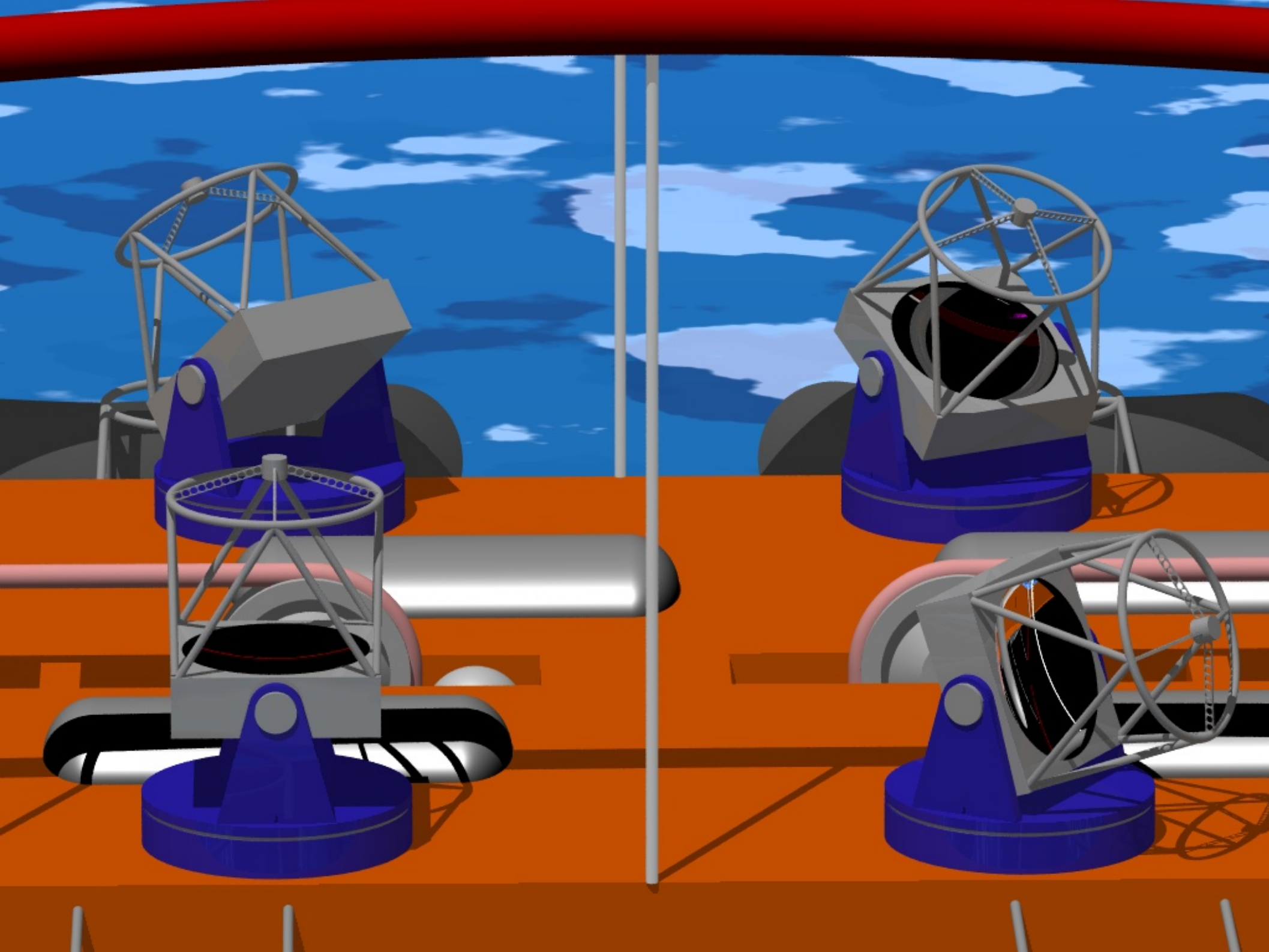
UNIVERSITY OF
Southampton
School of Engineering Sciences
www.southampton.ac.uk/ses

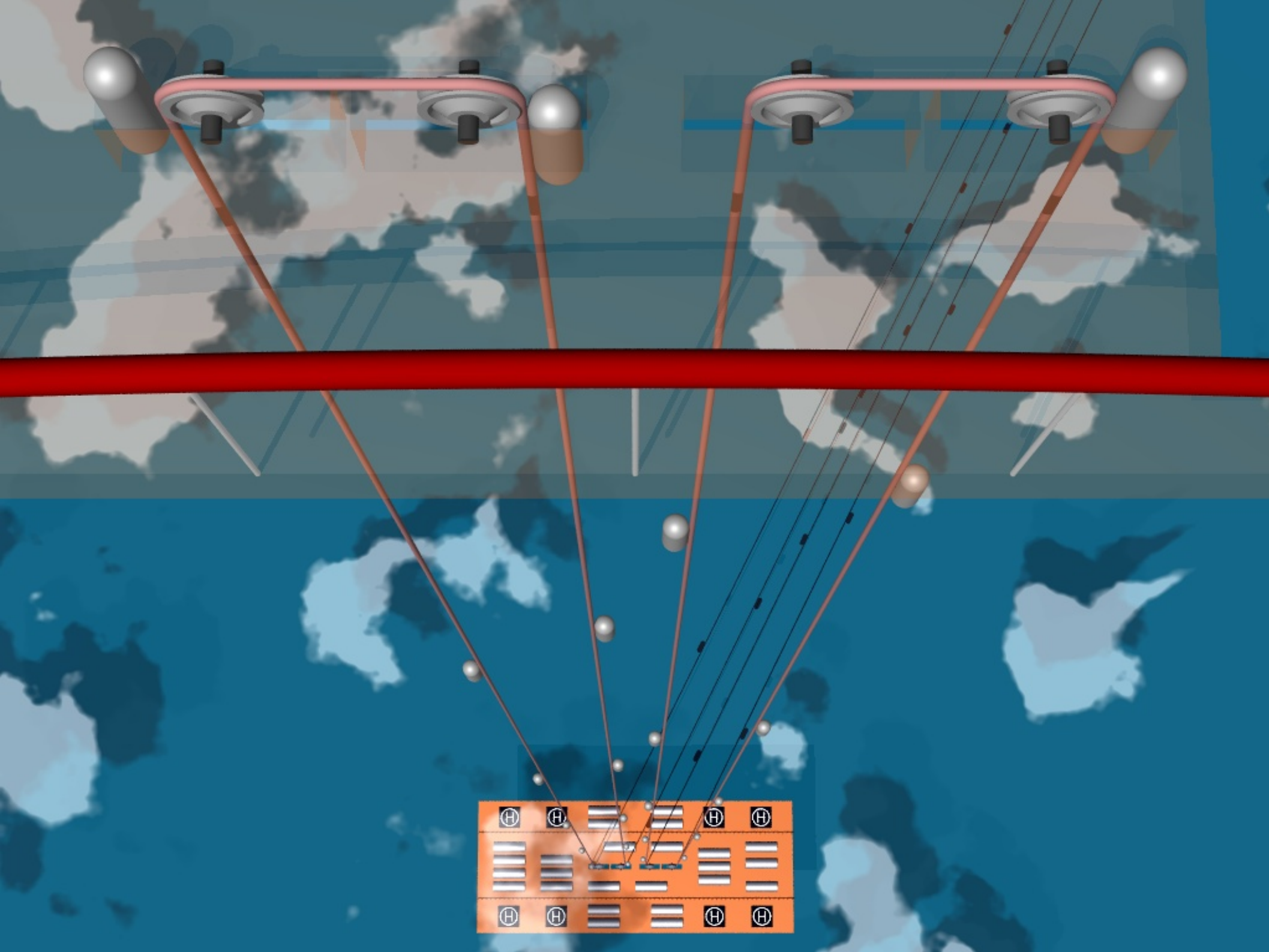

Climber
V_X
V_T
ΔX

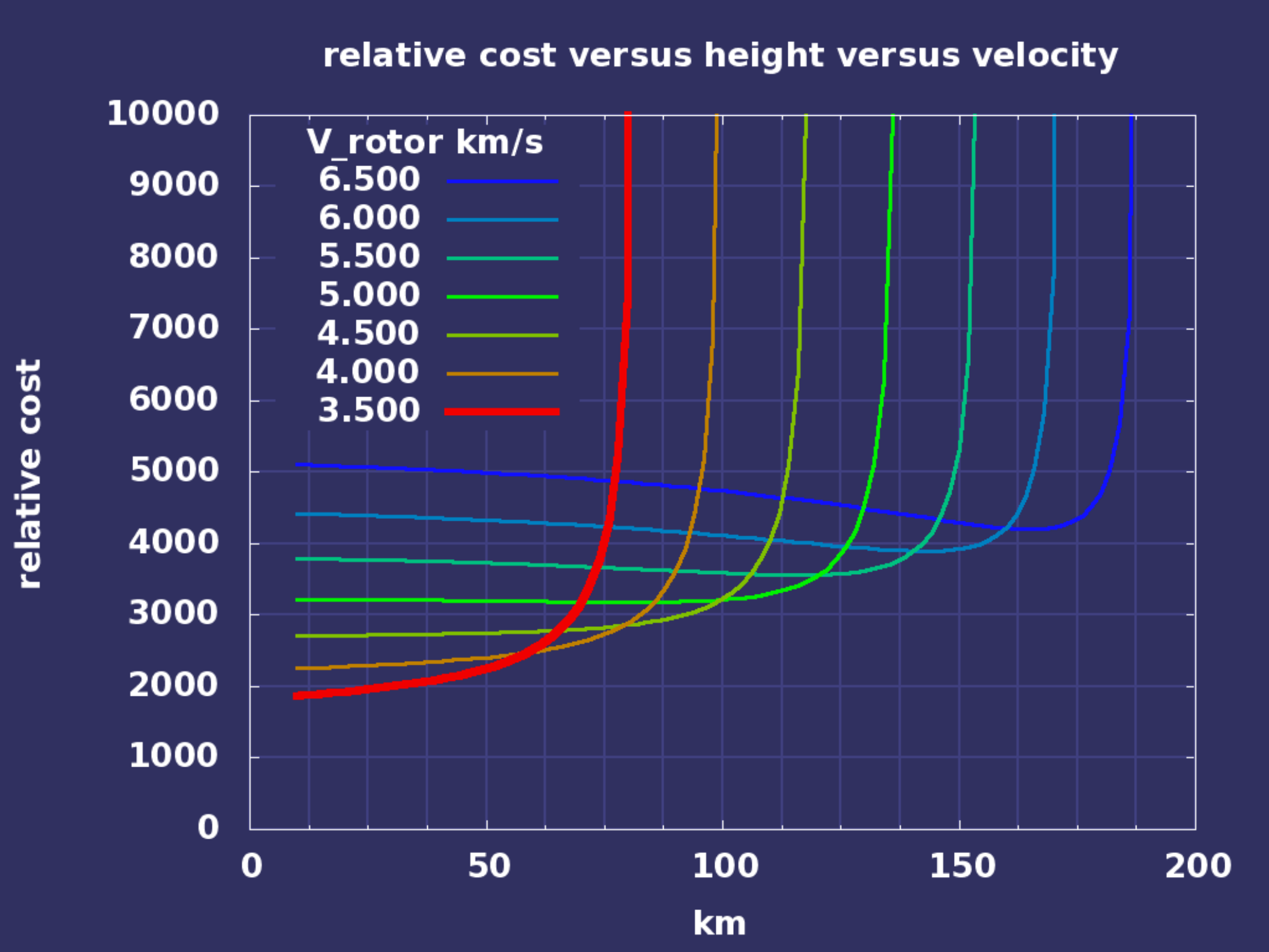






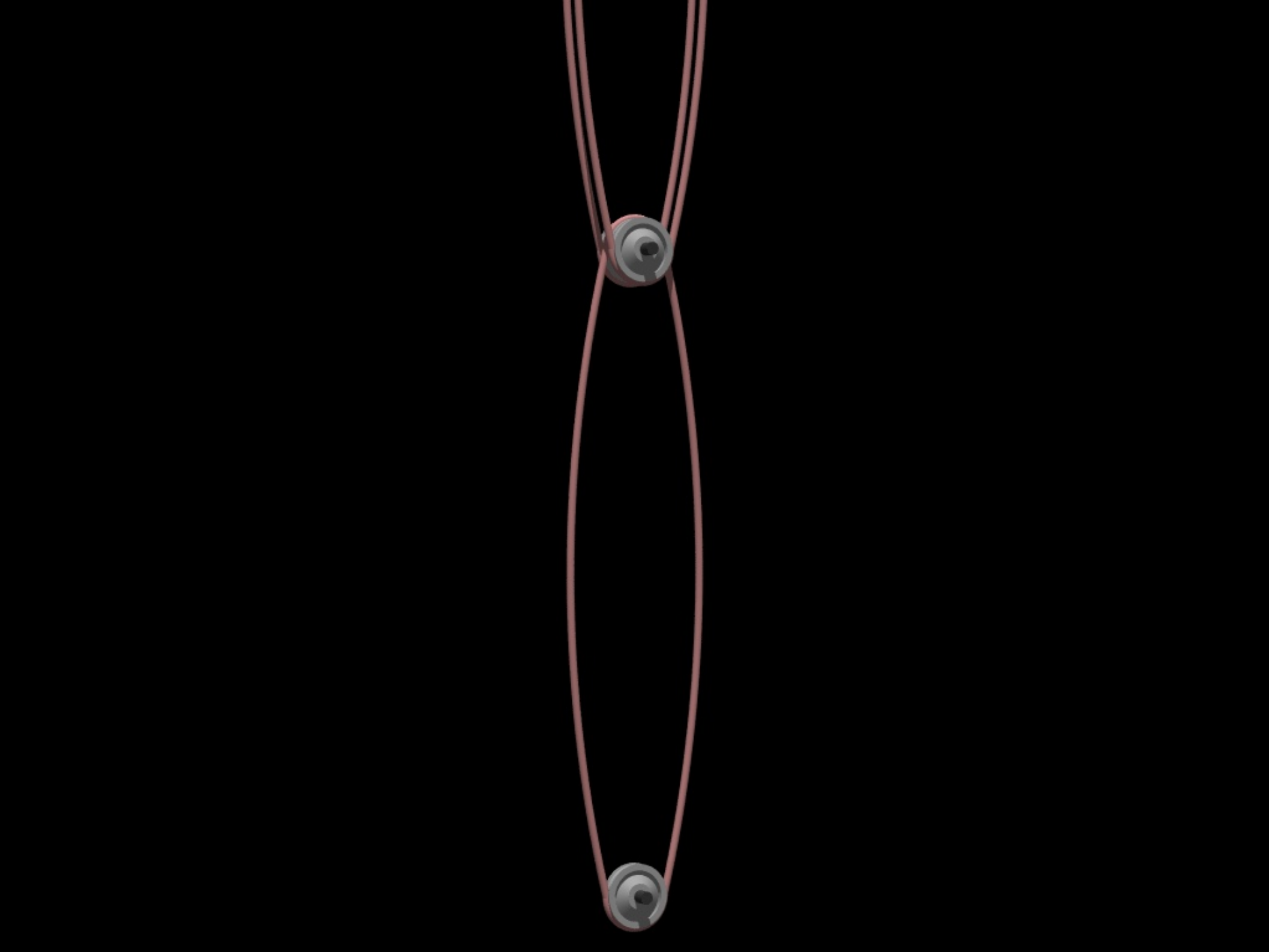


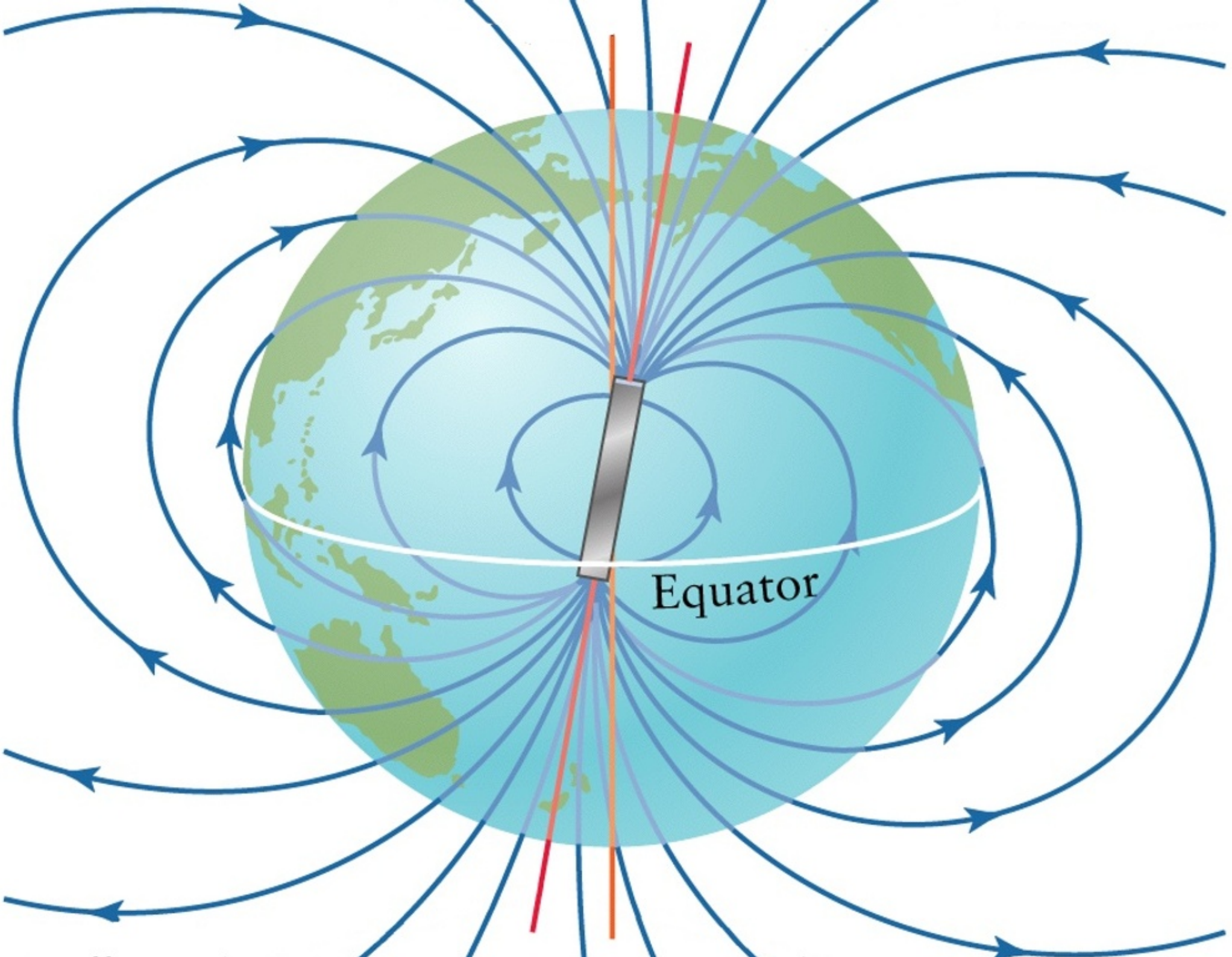


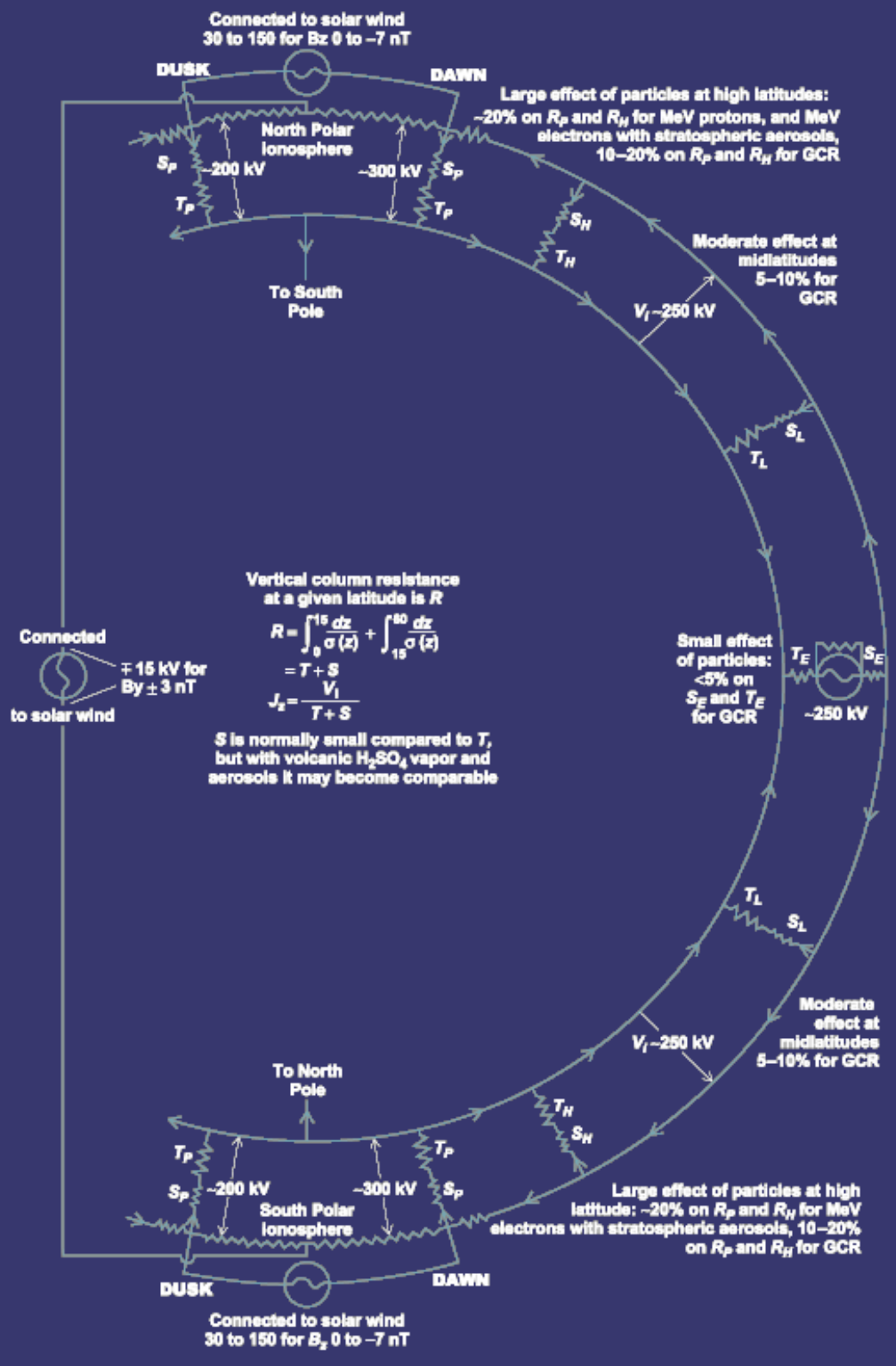

relative cost versus height versus velocity
V_rotor km/s
6.500
6.000
5.500
5.000
4.500
4.000
3.500
relative cost
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
0
50
100
150
200
km

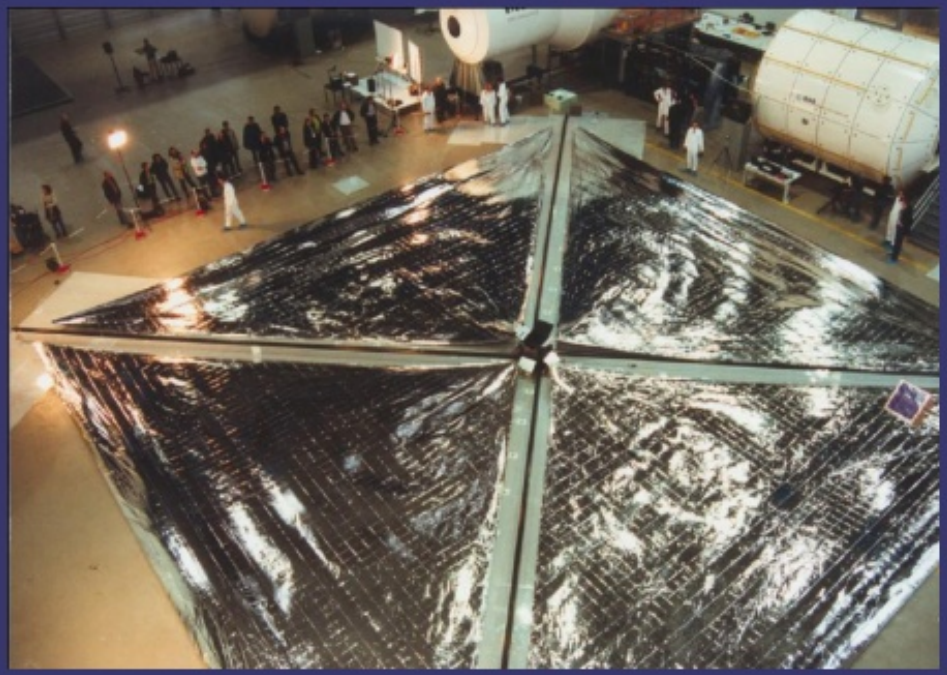
John Knapman
http://spacecable.org.uk
JMKnapman@aol.com

Keith Lofstrom
http://launchloop.com
keithl@server-sky.com




Equator


Connected to solar wind
30 to 150 for Bz 0 to –7 nT
DUSK
DAWN
Large effect of particles at high latitudes:
~20% on R_P and R_H for MeV protons, and MeV
electrons with stratospheric aerosols,
10–20% on R_P and R_H for GCR
North Polar
Ionosphere
S_P
~200 kV
~300 kV
S_P
T_P
T_P
S_H
T_H
To South
Pole
Moderate effect at
midlatitudes
5–10% for
GCR
V_I ~250 kV
S_L
T_L
Vertical column resistance
at a given latitude is R
$R = \int_0^{15} \frac{dz}{\sigma(z)} + \int_{15}^{60} \frac{dz}{\sigma(z)}$
$= T + S$
$J_z = \frac{V_I}{T+S}$
S is normally small compared to T,
but with volcanic H_2SO_4 vapor and
aerosols it may become comparable
Connected
to solar wind
∓ 15 kV for
By ± 3 nT
Small effect
of particles:
<5% on
S_E and T_E
for GCR
T_E
S_E
~250 kV
T_L
S_L
Moderate
effect at
midlatitudes
5–10% for GCR
V_I ~250 kV
To North
Pole
T_H
S_H
T_P
S_P
~200 kV
~300 kV
S_P
T_P
South Polar
Ionosphere
Large effect of particles at high
latitude: ~20% on R_P and R_H for MeV
electrons with stratospheric aerosols, 10–20%
on R_P and R_H for GCR
DUSK
DAWN
Connected to solar wind
30 to 150 for B_z 0 to –7 nT



ESA-DLR Solar Sail

Reflective Plastic
Not Photovoltaic

deployed in zero gee

Spacecraft Panels
< 100W / kg

ISS Solar Array
Wing 31W/kg
(not including truss)